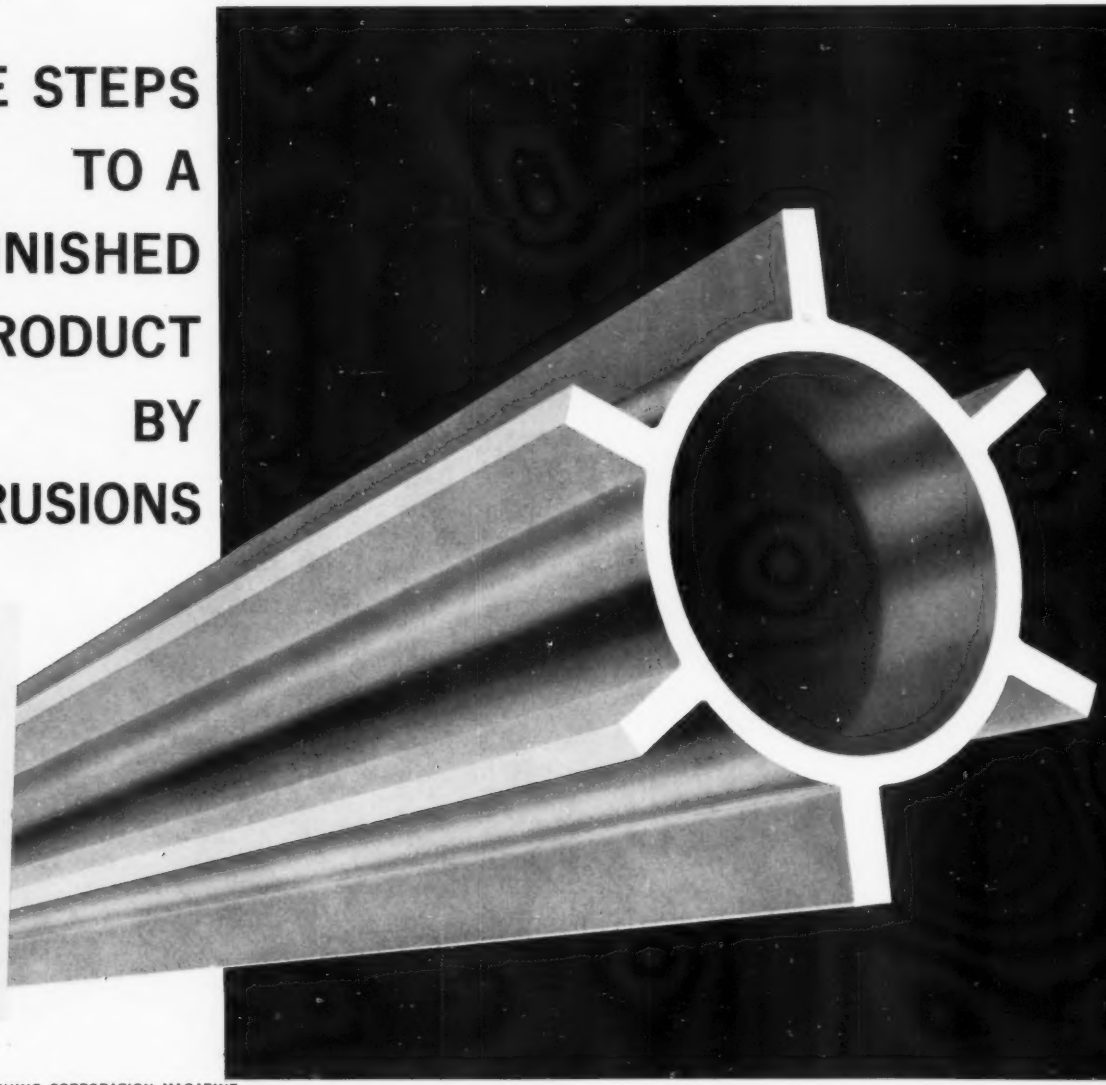
NOVEMBER 1959

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

THREE STEPS TO A FINISHED PRODUCT BY EXTRUSIONS



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N INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

PMM

The magazine for design, finishing and the use of:

SINTERINGS • INVESTMENT CASTINGS • EXTRUSIONS
PLASTER MOLD CASTINGS • SHELL MOLD CASTINGS
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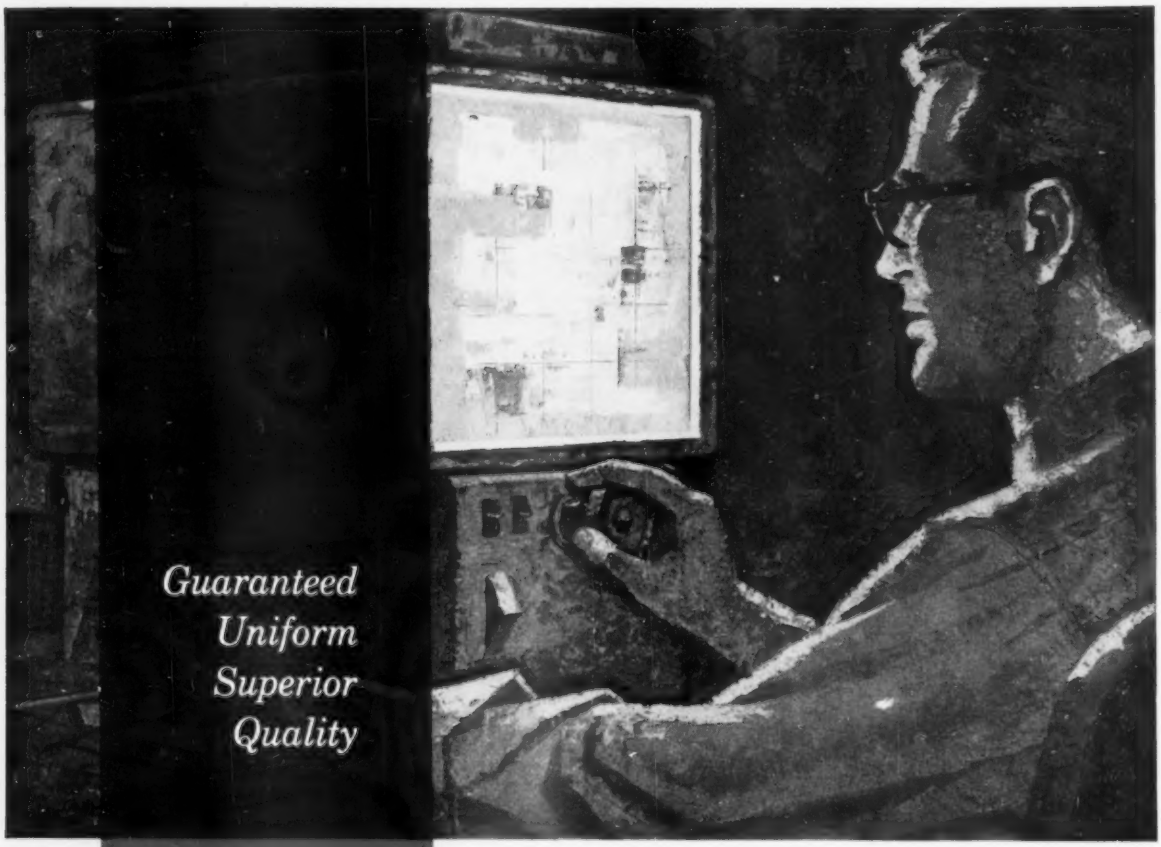

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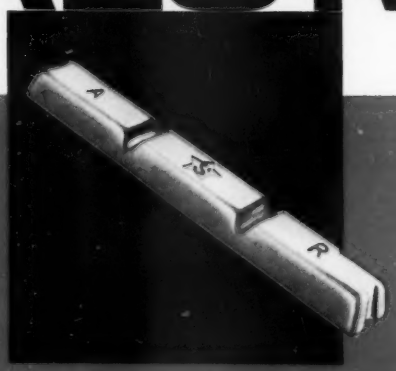
ALLOYS



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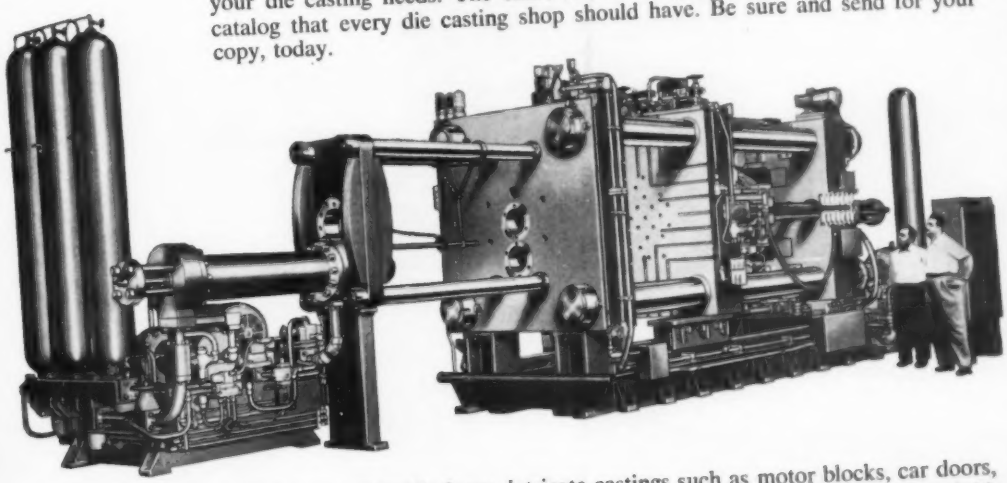
FILE NOTE:

There Are 17 Cast-Masters For Every Die Casting Need

Whether your requirements call for precision parts of a few ounces in weight or a massive casting of 85 pounds, there's a Cast-Master to fit the job. It's a line that sparkles with a range of models, each with outstanding features for your die casting needs. The chart below is reproduced from the brand new catalog that every die casting shop should have. Be sure and send for your copy, today.



MODEL 60A Cast-Master for exceptionally large, intricate castings such as motor blocks, car doors, large housings, etc. This huge 2000 ton Cast-Master has proved its usefulness in the field.

THE CAST-MASTER LINE FOR PRECISION DIE CASTINGS

PLUNGER GOOSENECK TYPE: *Zinc, Lead and Tin*

MODEL	7Z	9Z	18Z	15Z	26Z	30Z	46Z	50Z
Locking Pressure (Tons)	100	200	300	400	500	600	800	1000
Tie Bar Centers (In.) Ver.	16	19½	23	26	30½	32½	37	46
Hor.	16	19½	23	26	28½	32½	40	46
Tie Bar Diameter (In.)	2½	3½	4	5	5½	6	7	8
Space Between Tie Bars (In.)	13½x 13½	16x 16	19x 19	21x 21	23 Hor. 25 Ver.	26½x 26½	33 Hor. 30 Ver.	38x38
Die Mounting Plates (In.)	3½x 21½x 21½	4½x 26x 26	5x 32x 32	6x 36x 36	7x 38x 40	8x 48x 44	9x 52x 54	Stat. 12x60x60 Mov. 10x60x60
Die Thickness (In.) Min.	4	6	8	8	8	12	20	20
Max.	19	24	24	28	36	38	38	44
Die Stroke (In.) (Adjustable) Min.	4	6	6	8	9	12	18	18
Max.	8	10	10	12	15	18	24	24
Injection Cylinder Dia. (In.)	2½	3⅛	3⅝	4⅛	4⅛	4⅝	4⅝	6⅛
Injection Cylinder Stroke (In.)	6½	7¼	7¼	7¼	7¼	10	10	14
Metal Pot Capacity (Lbs.)	800	1000	1000	1000	1000	2000	2000	3000

COLD CHAMBER TYPE: *Aluminum, Brass and Magnesium*

7A	9A	18A	15A	26A	30A	46A	50A	60A
100	200	300	400	500	600	800	1000	2000
16	19½	23	26	30½	32½	37	46	62
16	19½	23	26	28½	32½	40	46	62
2½	3½	4	5	5½	6	7	8	11
13½x 13½	16x 16	19x 19	21x 21	23 Hor. 25 Ver.	26½x 26½	33 Hor. 30 Ver.	38x38	51x 51
3½x 21½x 21½	4½x 26x 26	5x 32x 32	6x 36x 36	7x 38x 40	8x 48x 44	9x 52x 54	Stat. 12x60x60 Mov. 10x60x60	18x 80x 80
4	6	8	8	8	12	20	20	20
19	24	24	28	36	38	38	44	54
4	6	6	8	9	12	18	18	22
8	10	10	12	15	18	24	24	36
3	4⅛	4⅛	4⅝	4⅝	5⅛	5⅝	6⅛	8¼
11	14½	12 to 16 Adj.	12 to 17½ Adj.	14 to 19½ Adj.	16 to 22 Adj.	18 to 24 Adj.	22 to 28 Adj.	30 Min. 44 Max.

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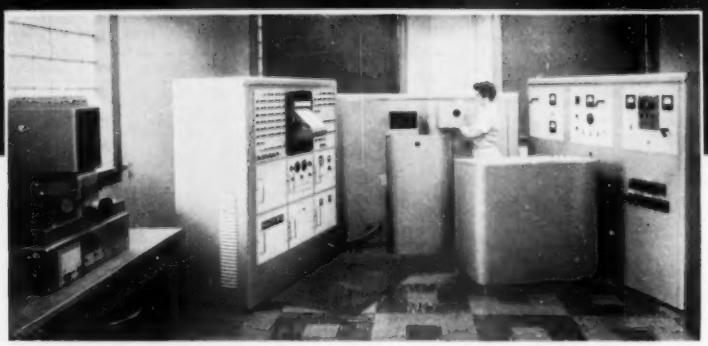

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IN THIS ISSUE

November, 1959: Volume 17 Number 11

FEATURE ARTICLES

41 **THREE STEPS TO A FINISHED PRODUCT**
It's doubtful that any other metal-forming method produces a finished shape as economically as extrusion: extrude, cut, minor finishing.

42 **GREATER INDUSTRIAL USE OF EXTRUSIONS**
A good barometer for predicting usage of extrusions is the sale of hot work die steels, and the trend is upward.

43 **COLD EXTRUSION OF STEEL**
P. G. Witteman of Bethlehem Steel Co. tells what it is, what it does to the properties of steel, and what its advantages are.

44 **PROGRESS REPORT FROM INTEGRATED EXTRUDERS**
Various producers discuss significant contributions to the industry, where it stands today, and what the future looks like.

46 **WHAT SHAPES CAN BE EXTRUDED?**
A total of 64 examples of extruded shapes are illustrated.

54 **HOW LIGHTOLIER BUYS EXTRUSIONS**
There's a lot more to buying extrusions than just signing an order. Here's how one user handles the many problems that come up.

56 **IRON CARBON SYSTEM IN POWDER METALLURGY**
P. Ulf Gummeson of Hoeganaes Sponge Iron Corp. points out some of the advantages, as well as difficulties, of this system.

60 **METALLURGY OF DIE CAST ALUMINUM ALLOYS**
Walter Bonsack, Aluminum and Magnesium, Inc., makes the bold statement that most aluminum casting alloys can be die cast, then tells why.

64 **PROPERTIES OF EXTRUSIONS**
Tool steels and heat treatments for steel extrusions.

66 **INVESTMENT CASTING IN SHELL MOLDS**
Here's the first of three reports on this subject. It covers the use of silicate shells and how they're made.

68 **NEW VACUUM DEGASSING PROCESS**
The ladle degassing of alloy steels developed by A. Finkl & Sons Co. is described, together with advantages of lowered hydrogen content.

70 **DESIGN TIPS**
How to cut costs with correct design plus cold impact extrusion.

22 **METAL SHOW EXHIBITORS**
Exhibits at the 41st Metal Exposition of interest to PMM readers.

FINISHING SECTION

73 **ANODIC OXIDATION OF ALUMINUM ALLOYS**
A Complete report on the process by R. E. Pettit of The Diversey Corp. covers all phases and procedures.

78 **AUTOMATIC ELECTROSTATIC SPRAY PAINTING**
How the installation of Ransburg automatic electrostatic spray painting units improved quality and cut costs.

DEPARTMENTS

8 Casting About
14 New Products
28 Industry News
106 Useful Literature
108 Opportunities
113 Data in Ads

BEFORE
Open seam rolled steel case with three welded lug hinges.
AFTER
Notching of double channel extrusion at left produces strong, seamless hinge section.

Notched Extrusion Produces Better Binder Hinge

FOR WILSON JONES COMPANY

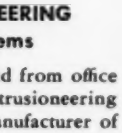
ALUMINUM EXTRUSIONEERING Helps Solve Design Problems

Even though your product is far removed from office binders, this example of P-E Aluminum Extrusioneering for Wilson Jones Company (leading manufacturer of loose-leaf record binders and equipment) may suggest ways to improve your product and cut costs. For years, sectional post cases had been built of fabric-covered, rolled steel sections with welded hinge lugs. As illustrated, slotting a seamless, double channel extrusion now provides a stronger post section which, with a mounting section, produces a more durable continuous hinge.

Extrusion Method Provides Greater Strength, Reduced Weight

Advantages over the former steel case with welded hinges include greater natural beauty, long-lasting aluminum finish, simplified fabricating, and greater hinge strength in less weight. Perhaps P-E Extrusioneering and our non-competitive mill service can help you. Simply send a blueprint or rough sketch for quotation or suggestions. Over 5,000 standard shapes are available without die charge.

WRITE FOR FREE CASE STUDIES—New bulletin "P-E Extrusioneering News" illustrates cost-cutting solutions to various design problems, gives helpful technical and fabricating data.



3 MORE COST-CUTTING EXAMPLES OF P-E EXTRUSIONEERING

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Editorial and executive offices: 812 Huron Rd., Cleveland 15, O.

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SUBSCRIPTIONS in U.S. and possessions: $7, 1 year; $12, 2 years. Canada: $8 per year. Foreign: $10 per year, payable in advance in U.S. funds. U.K.: £3.5.0 per year payable in Sterling to London office. Single copies, when available: 1 to 10—75¢ each; 11 to 25 60¢ each; over 25 45¢ each.

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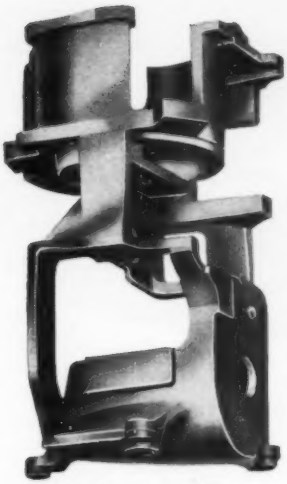
IN ALUMINUM OR ZINC



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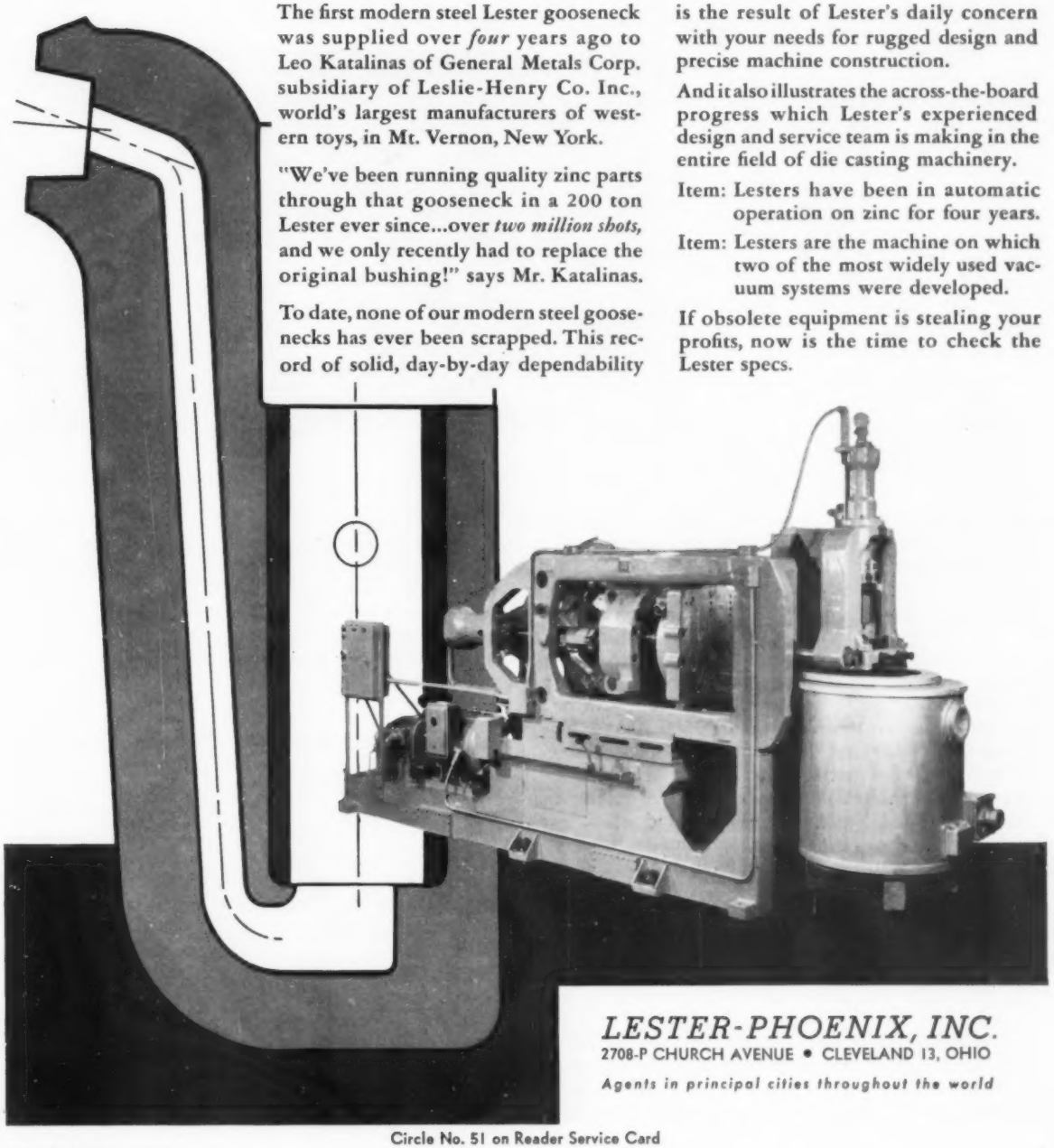

The first modern steel Lester gooseneck was supplied over *four* years ago to Leo Katalinas of General Metals Corp. subsidiary of Leslie-Henry Co. Inc., world's largest manufacturers of western toys, in Mt. Vernon, New York.

"We've been running quality zinc parts through that gooseneck in a 200 ton Lester ever since...over *two million shots,* and we only recently had to replace the original bushing!" says Mr. Katalinas.

To date, none of our modern steel goosenecks has ever been scrapped. This record of solid, day-by-day dependability is the result of Lester's daily concern with your needs for rugged design and precise machine construction.

And it also illustrates the across-the-board progress which Lester's experienced design and service team is making in the entire field of die casting machinery.

Item: Lesters have been in automatic operation on zinc for four years.

Item: Lesters are the machine on which two of the most widely used vacuum systems were developed.

If obsolete equipment is stealing your profits, now is the time to check the Lester specs.

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CASTING ABOUT

technical news of applications & processes involving precision metal moldings

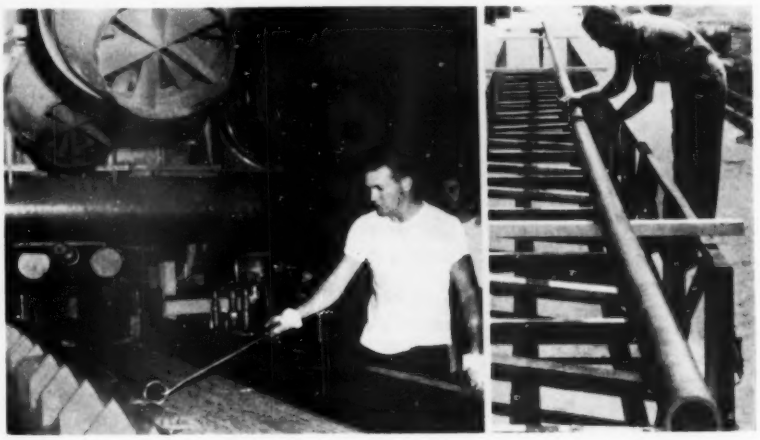
EXOTIC METALS, the term commonly used to describe zirconium, titanium, beryllium and a few others, is rapidly losing its meaning. As metallurgists learn more and more about these elements and about alloys based on them, their uniqueness disappears. Like aluminum, these metals are passing from the stage of a laboratory curiosity to commercial application. With the development by Harvey Aluminum of commercial methods for the extrusion of zirconium alloy tubing in long lengths, another giant step forward has been taken.

Zircaloy-2 alloy is now in commercial production as seamless extruded tubing in lengths up to 51-½ feet. The tubes now being produced are 3.58″ O.D. with a 0.360″ wall. They are for use in nuclear power reactors.

Before the development of this extrusion process for zirconium alloys, these tubes were made by welding three smaller extrusions together. With the one piece section, improved physical properties, elimination of weldments, and lowered costs are secured.

For these large tubes, a 500-pound billet is pushed in an 8000-ton hydraulic press. Exacting tool tolerances, careful container control, and special techniques in melting, cladding, and handling all contributed to the success of the operation.

With the development of the new methods, unalloyed or alloyed zirconium in varying sizes and with or without internal ribs or external fins can be made. The extruded zirconium has excellent resistance to corrosion and good physical properties.



MOLTEN FLUORIDES present a material problem which has little equal as a corrosive medium. A new alloy called Hastelloy N has been developed by Haynes Stellite Co. This nickel base material can be used in environments involving fluorides at high temperatures. An outstanding characteristic is the alloy's resistance to embrittlement when continuously exposed to temperatures up to 1600°F. Tests have also shown that the oxidation, in air, is so low that the alloy can be used for continuous service up to 1800°F and for intermittent operations up to possibly 1900°F, depending upon the particular conditions of exposure and other factors.

The alloy can be extruded, cast in sand, shell, or investments, forged, hot rolled, and drawn. Its hot working temperature is between 1600°F and 2150°F. It is readily weldable. In addition to the cast and extruded forms, Hastelloy N can be fabricated into sheet, plate, bar, wire, or coated welding electrodes.

THE JEWELRY INDUSTRY is an important user of zinc base die castings. Very appreciable quantities are used in the manufacture of costume jewelry. Now Amos Parrish & Co. predict that there will be an even greater use in the coming seasons. Braided and twisted metal designs in a variety of textures will be popular. There will be heavy promotional campaigns on "antique" coins for bracelets, cufflinks, earrings, etc., as well as matching copies of Etruscan bracelet-cuffs. As a result of the baby boom in the 1940s, the industry expects a boom for gift events such as weddings, engagements, commencements, and other occasions where gift giving is customary. It's one good aftermath of the war.

ULTRA HIGH PURITY METALS required for rocket and missile development are finding new uses divorced from their original applications. Some of the metals involved are relative strangers (as metals). For example: bismuth, tellurium, arsenic, indium, selenium, germanium. All of these are of interest because of their unique thermoelectric and semi-conductor properties. Put two of them together and pass an electric current through the junction. You get either a heating or a cooling effect depending on the direction of current flow (this is the Peltier effect). There's the possibility of opening an entirely new system of both heating or refrigeration. Watch these developments, don't discount them because of present scarcity of the metals. Remember that aluminum used to cost around $600 per pound and titanium was, just a very few years ago, a laboratory curosity.

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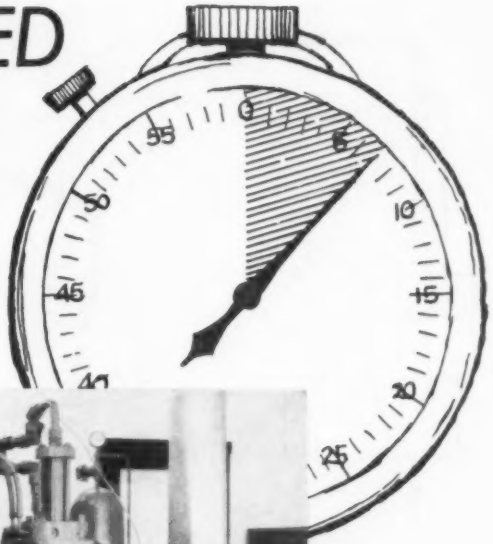
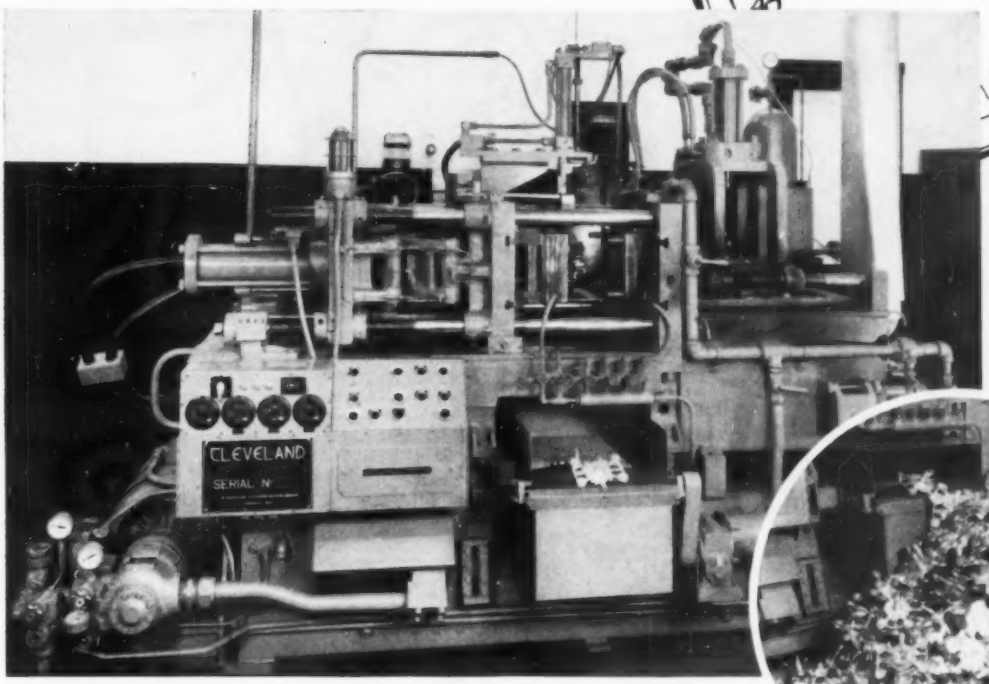
casts four perfect parts every seven seconds!





Here's die casting machine automation to the *nth* degree! The Cleveland shown above is in operation in our Die Casting Development Center, producing a gate of four zinc parts at a rate exceeding 500 shots per hour. This fast cycle operation includes casting ejection and conveying, plus automatic die lubrication.

Complete, fail-safe controls are incorporated. As an example, initial die closing uses low hydraulic pressure. If flash or other foreign matter of 0.012" or more thickness exists between the die halves, the die opens, stopping the cycle, and a signal light on the control panel indicates the source of stoppage. To speed set-up, all machine operating sequences are programmed by templates.

To die casters interested in cutting costs through automation, we extend a cordial invitation to schedule a visit to Cincinnati to see this machine in action. And this same invitation stands for those who desire to examine the industry's lowest cost, most efficient automatic aluminum ladling and vacuum die evacuation system in operation...for Cleveland has that, too!

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. . . and you have a choice of high-alloy and stainless steels, and non-ferrous metals to match your job requirements.

. . . a wide variety of shapes, in solid or tubular form, are produced to meet design needs.

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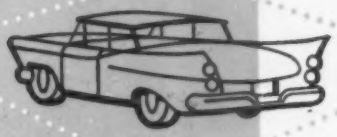


save production time lower costs and improve product performance

This two unit assembly, produced by the American Sinteel Corporation, is the control mechanism used on the reclining seats of a 1959 automobile. It is an excellent example of how a multitude of desirable features can be incorporated into a powdered metal part.

This pump rotor with its seven "slippers" is employed in the automatic transmission of an automobile. Because of its complex design, it was a difficult and costly part to produce by conventional methods. American Sinteel engineers were able to solve the problems involved and now the part is being produced on a production basis at a low unit cost.

Low cost, high speed production, close tolerances and unusual design possibilities are among the many advantages of Sinteel powdered metal parts. There are literally thousands of applications, including such products as gears, cams, complex nuts and fasteners, special purpose filters and structural members from steel, iron, brass and copper alloys, where Sinteel powdered metal parts can improve the performance of products now being made by other, more expensive methods of manufacturing. Powdered metal parts are available with many special characteristics, including self-lubrication, controlled porosity for infiltration and good electrical and magnetic properties for pole pieces, armatures and cores. Whatever your product requirements are, American Sinteel Corporation can produce precision parts to your specifications at substantial savings.

For more information on Sinteel ferrous and non-ferrous ▶ powdered metal products, send for your free copy of Engineering Bulletin #3020. It contains valuable information on Sinteel alloys and designing for Sinteel powdered metal products.

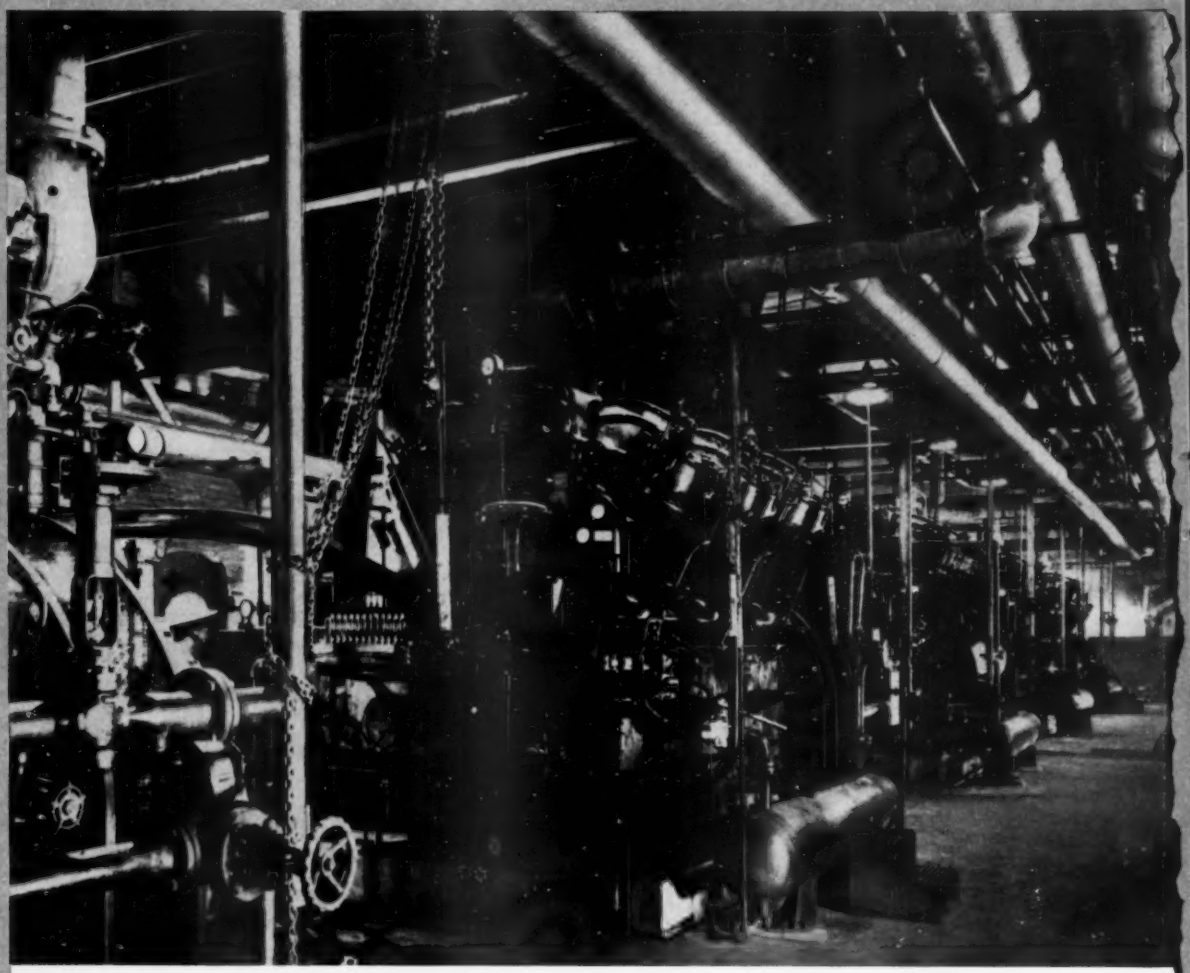
SINTEEL®

AMERICAN SINTEEL CORPORATION

39 SAW MILL RIVER ROAD, YONKERS, NEW YORK

A SUBSIDIARY OF MUELLER BRASS CO.

Circle No. 4 on Reader Service Card



Cellulubes by Celanese minimize threat of fire

Protection of your personnel, plant and equipment against fire and explosion is a vital need. Cellulubes made by the Celanese Corporation of America can help you provide this protection. They resist the propagation of flame under conditions which could result in serious fires with other lubricants. And they give you so much more!

CELANESE CORPORATION OF AMERICA, CHEMICAL DIVISION
DEPT. 589-K, 180 MADISON AVENUE, NEW YORK 16, N. Y.

Please send me:

☐ Technical bulletin ☐ Sample of_____viscosity.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

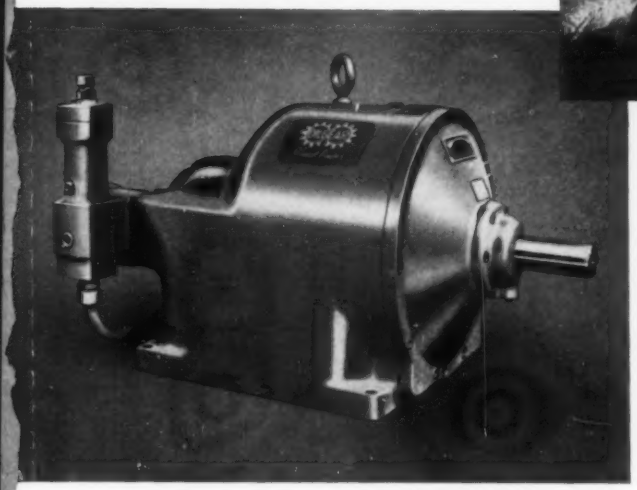
Application I have in mind_____

FM

Factory Mutual-Approved
(Cellulubes 150 and 220)

CYLINDER WEAR PROVED NEGLIGIBLE when fire-resistant Cellulubes were used to lubricate four Cooper-Bessemer air compressors, as two years' testing showed. Moreover, there were no pressure surges or evidence of fire in the air accumulator. Deposits normally found in compressor auxiliaries and valves were reduced or eliminated thanks to the detergent action of Cellulubes. Conventional lubricators could be used to pump the Cellulubes.

SAFETY, EFFICIENCY, COST SAVINGS are the advantages of Cellulubes discovered by Trunkline Gas Company Texas, after using these lubricant fluids for three years in their air compressors: Cellulubes eliminate risk to personnel from fire, explosion, fragmentation. Cellulubes do not get dirty or burn away by friction or compression. Cellulubes save on replacement costs, downtime, and maintenance. Cellulubes keep machinery smooth-running and clean.



USED FOR YEARS under rigorous conditions in pumps made by the Oilgear Company of Milwaukee, Wisconsin, Cellulubes provided superior protection against excessive wear. Cellulubes, which are phosphate ester synthetic fluids, can be employed in pumps at higher temperatures than fire-resistant fluids which contain water. They are suitable for use in all types of hydraulic pumps being used today, including vane, piston and gear pumps.

and explosion...protect machines against wear

For example, Cellulubes give overall wear protection comparable to that of premium petroleum oils. They present no foaming problem and have no additives which might deposit in the system. In fact, these synthetic lubricants and hydraulic fluids have a cleansing action inside machinery. Their vapor pressure is extremely low; this means that fluid losses are negligible even under severe operating conditions. Cellulubes are available in six viscosity ranges to meet all the standard needs of industry. Viscosity ratings do not change despite the toughest conditions of mechanical shear.

A pioneer in fire-resistant fluids, Celanese offers you years of field experience and research background to serve your needs. For more information on Cellulubes, mail the coupon to us today.

Celanese Corporation of America, Chemical Division, 180 Madison Ave., New York 16, N. Y.

Celanese® Cellulube®

Cellulubes... Celanese CHEMICALS fire-resistant functional fluids

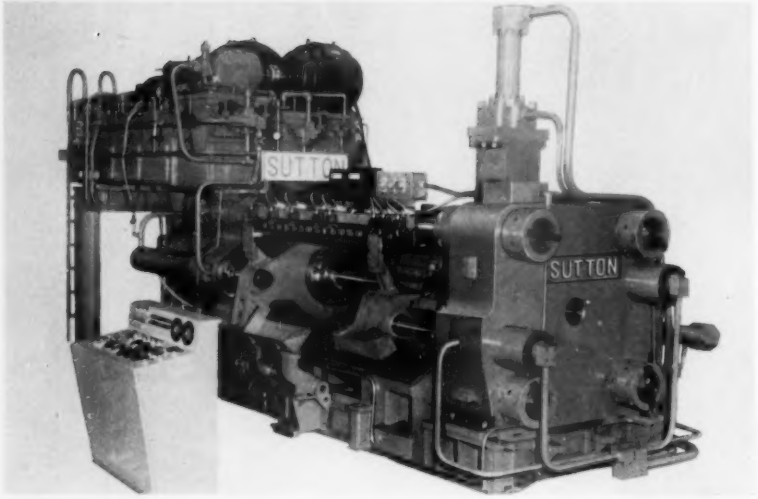
In Canada: Canadian Chemical Company Limited, 2035 Guy St., Montreal, Toronto, Vancouver • Export Sales: Amcel Co., Inc., and Pan Amcel Co. Inc., 180 Madison Ave., New York 16

Circle No. 19 on Reader Service Card

CELANESE CELLULUBES

NEW PRODUCTS AND DEVELOPMENTS

Qualified readers can get complete details on these products. Use the Reader Service Cards. You'll find them facing page 114 of this issue



1250/1500 TON EXTRUDER

This 1250/1500 ton horizontal hydraulic extrusion press is just one of several new presses introduced by the SUTTON ENGINEERING CO. In a typical installation this new press is said to have increased output by 40 percent. The company offers extrusion presses in both horizontal and vertical designs for all modern ferrous and non-ferrous metals. Featured on the 1500/1800 ton aluminum extrusion press is a special electric-hydraulic system for entirely automatic cycling with solid, port-hole or bridge-type dies.

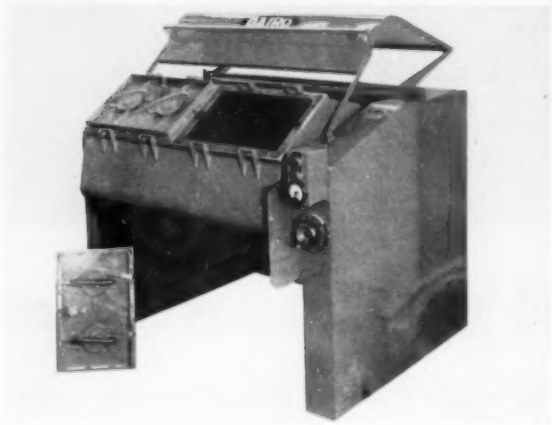
Circle No. 235 on Reader Service Card

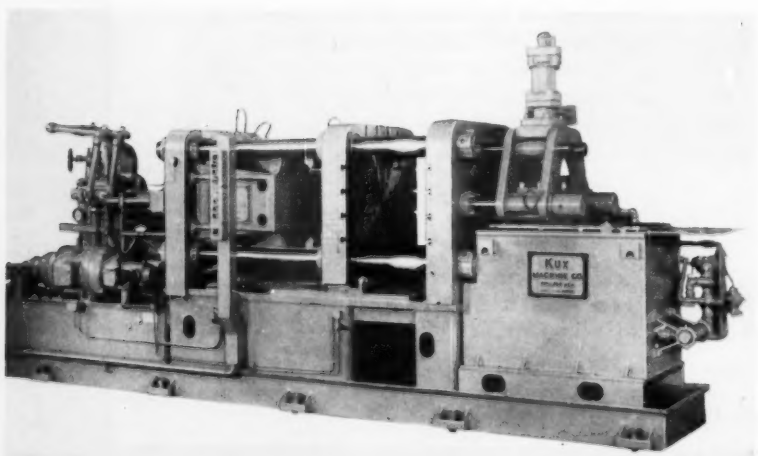
BARREL FINISHING MACHINE IS RUGGED

Finishmaster, is a new horizontal barrel finishing machine introduced by the BAIRD MACHINE CO. The unit requires only five square feet of floor space. The doors are lightweight so that they can be lifted by hand. Being less than four feet high, all loading and unloading equipment can be carried over the top of the machine.

Other features include: A variable speed drive for barrel speeds between 8 and 24 rpm; A built-in brake-motor which holds the barrel in position, and a limit switch which permits jogging but not running of the barrel when the guard is raised. Total capacity of the unit is 2000 lb.

Circle No. 236 on Reader Service Card



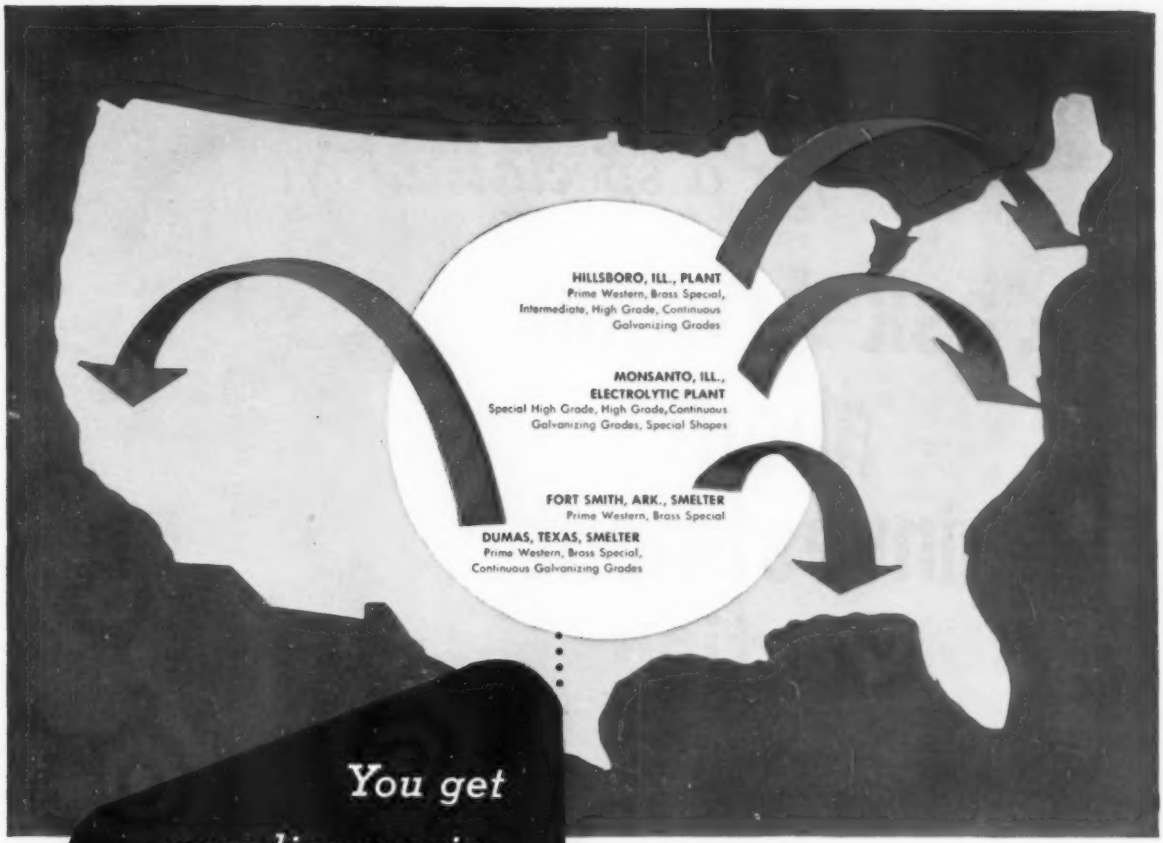


AUTOMATIC DIE CASTER

KUX MACHINE CO. has introduced a 200 ton, continuous cycling, hot chamber die casting machine. Strain gage proven, the unit will operate at a speed of over 900 cycles per hour. Features include a 15¼" x 15¼" clearance space between 3" dia. tie bars and a 10" die separation stroke. A 6 lb. zinc die casting can be produced at 1800 psi injection pressure. Kux Vac-U-Die and Vac-U-Feed systems are available. Illustrated is Model BH-500, a new 500 ton hot chamber machine.

Circle No. 237 on Reader Service Card

continued on page 93


HILLSBORO, ILL., PLANT
Prime Western, Brass Special, Intermediate, High Grade, Continuous Galvanizing Grades
MONSANTO, ILL., ELECTROLYTIC PLANT
Special High Grade, High Grade, Continuous Galvanizing Grades, Special Shapes
FORT SMITH, ARK., SMELTER
Prime Western, Brass Special
DUMAS, TEXAS, SMELTER
Prime Western, Brass Special, Continuous Galvanizing Grades

You get speedier service from the ZINC ZONE

Central location of American Zinc plants assures prompt deliveries of slab zinc to any point in the nation.

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
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LEAD-FREE and LEADED ZINC OXIDES
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AGRICULTURAL LIMESTONE
CRUSHED STONE

American Zinc Sales Company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY

Columbus, Ohio • Chicago • St. Louis • New York • Detroit • Pittsburgh

Circle No. 7 on Reader Service Card

Does your new design call for a special alloy?

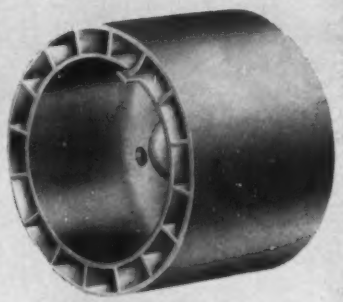
...ask Arwood about investment casting

When you design your new part for investment casting, you neatly sidestep that age-old designer's dilemma: part performance versus ease of production.

If the best alloy for the application is a machinist's nightmare, specify it and let Arwood worry about it. It won't bother us; our four foundries cast everything from magnesium and aluminum to cobalt-base and nickel-base alloys and stainless steel.

Arwood's complete service from blueprint to finished investment casting frees your hands to design for function and end use. Arwood will give you the shape you need, the alloy you need, and the quantities you need, from a few hundred to many thousands.

Write today for your free copy of the new 44-page Arwood "Practical Guide to Investment Casting". It provides all the information you need to evaluate the technique and use it to help solve your design problems.



magnesium

cobalt alloy

stainless steel

MACHINE THE SIMPLE...CAST THE COMPLEX

arwood

ARWOOD PRECISION CASTING CORP., 323 W. 44th St., N. Y. 36, N. Y.

A complete service from design through tooling, production and finish machining.
Sixty-two engineering consultants from coast to coast.

PLANTS IN BROOKLYN, N. Y.; TILTON, N. H.; GROTON, CONN. & LOS ANGELES, CALIF.

Circle No. 9 on Reader Service Card

Ideal for Air or Vacuum Melting, Sintering and Hot Pressing

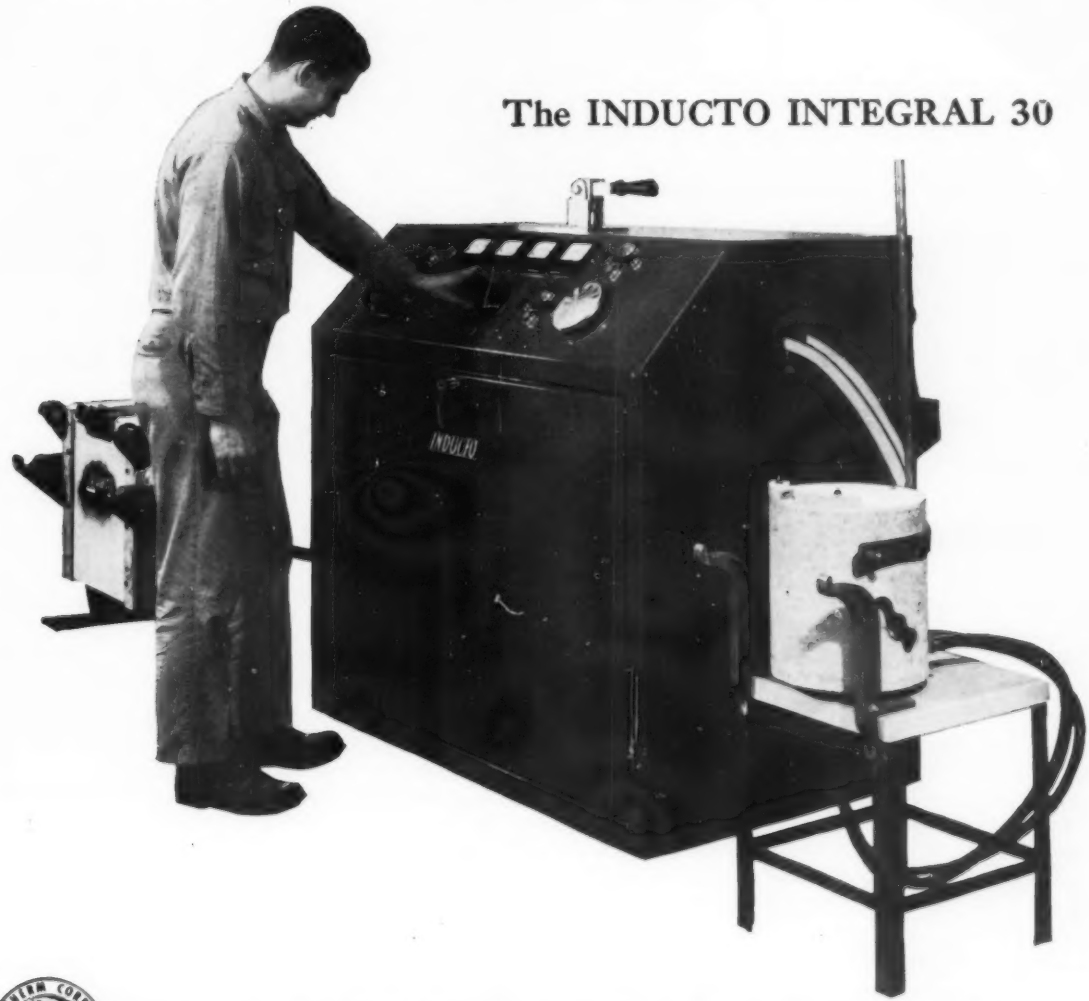
The Inducto Integral 30 is an efficient and economical melting unit that can be easily adapted to a variety of applications. Its console control panel contains all the equipment necessary to operate high-frequency induction furnaces and coils—a motor-generator set, capacitors, transformer and complete controls. Over 20 capacitor and 8 transformer steps, easily controlled from the front, provide the necessary flexibility to assure matching full power to all load conditions throughout the heating or melting cycles. The entire unit is designed for maximum dependability and ease of operation.

The Integral 30 is installed simply by connecting it to a 220 or 440 volt power supply, a cold water line and a drain. In fact, it is so compact and easy to install anywhere, the console can be made portable just by mounting it on casters.

Unique water-cooled leads simultaneously supply power and water to the furnaces. The same leads, with slight modifications, provide an economical power entry system for vacuum melting applications.

The Integral 30, with all the advantages of induction melting and Inducto engineering features, is truly the outstanding melting unit in the 5 to 100 pound range. No other equipment can offer you the same versatility, efficiency and economy. For complete details, write for Descriptive Bulletin 20-30, Inductotherm Corp., 412 Illinois Ave., Delanco, N. J.

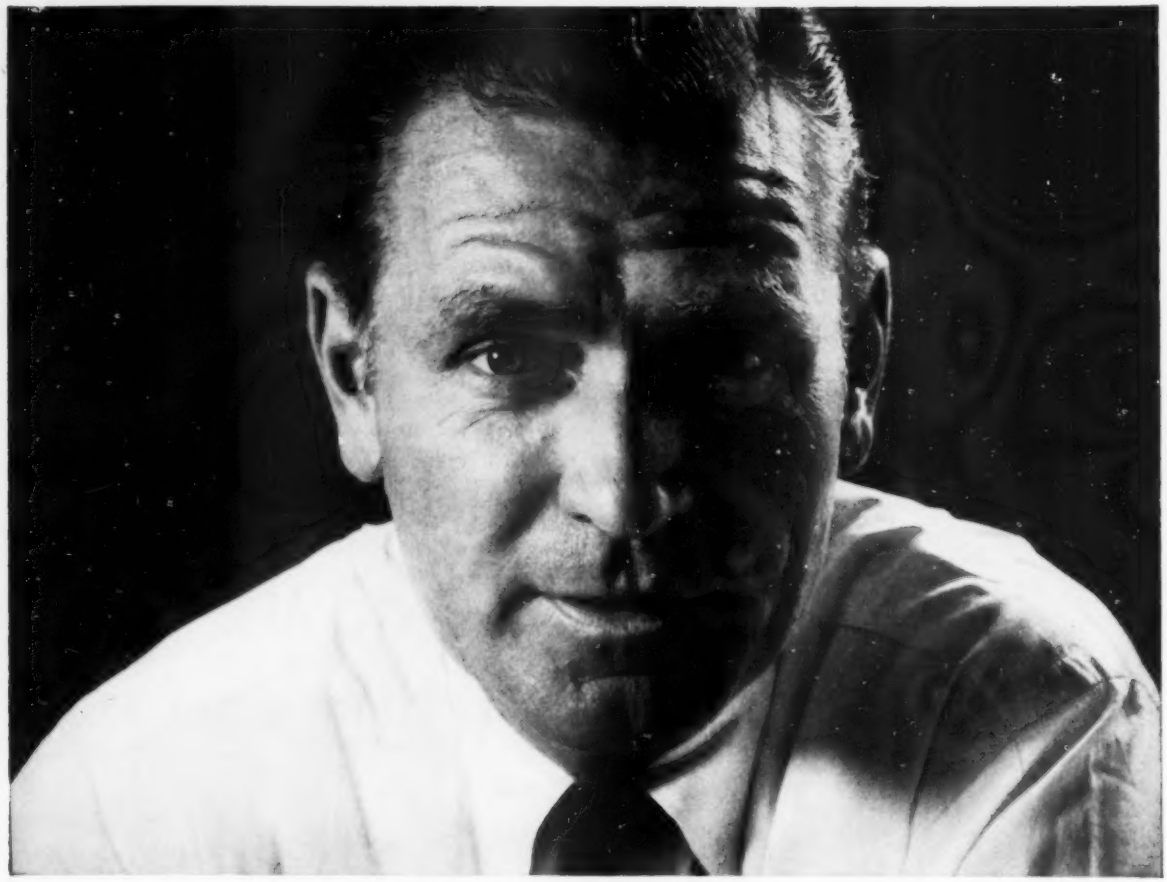
The INDUCTO INTEGRAL 30



INDUCTOTHERM

INDUCTO ... the mark of modern melting

Circle No. 45 on Reader Service Card



My answer for fire-resistant fluids is... UCON Hydrolubes

Q. WHAT FIRE-RESISTANT HYDRAULIC FLUID SHOULD YOU USE?

UCON hydrolubes are the economical answer for fire-resistance in hydraulic fluids. Extensive field tests and more than 10 years of routine use in industrial hydraulic equipment have proven the safety and economy of UCON hydrolubes. And, UCON hydrolubes are approved for use by Factory Mutual Laboratories.

• UCON hydrolubes have better viscosity-temperature properties than the phosphate-ester fluids, that cost as much as 40 per cent more. UCON hydrolubes are shear-stable. And, they have none of the harmful effects on packings and seals that the phosphate-esters exhibit.

• UCON hydrolubes provide maximum protection against liquid and vapor phase corrosion, and have outstanding anti-wear characteristics. Thus, pump replacement costs are held to a minimum. Cheaper water-in-oil emulsions have poor emulsion stability. In addition, water-in-oil emulsions lose fire-resistant properties and give inadequate lubrication.

• Most hydraulic systems can be quickly and easily converted to fire-resistant UCON hydrolubes. Standard flushing and refilling procedures, involving a minimum of time and effort are sufficient. In many instances, reduced leakage losses have been reported.

Remember—UCON hydrolubes are the economical answer for fire-resistance in hydraulic fluids. Replacement is quick and easy and loss is low.

Get all the facts on UCON hydrolubes in the booklet, "UCON Hydrolubes Spell Safety." For a copy ask a CARBIDE Technical Representative; or write Union Carbide Chemicals Company, Room 328, Department J2, 30 East 42nd Street, New York 17, N. Y.

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UNION CARBIDE CHEMICALS COMPANY / DIVISION OF UNION CARBIDE CORPORATION

Circle No. 77 on Reader Service Card

WHAT IS T^{n}CP?

a proprietary refining treatment that makes alloys easier to melt, improves quality, properties and cost control

T^{n}CP IS AVAILABLE *ONLY* IN *Rx*MET® MASTER ALLOYS!

CHECK THIS LIST FOR *Rx*MET® ALLOYS TO SUIT YOUR CASTING REQUIREMENTS— WRITE FOR INFORMATION!

STAINLESS STEELS—Series 300 & 400.
TOOL & DIE STEELS—
Air-, Oil-, & Water-Hardening.
Tungsten & Moly High-Speed.
SUPERALLOYS and SPECIAL STAINLESS STEELS.
PLAIN CARBON & LOW-ALLOY STEELS.
VACUUM-MELTED ALLOYS.

PROPERTIES OF ACTUAL 17-4PH PRODUCTION HEATS

HEAT NUMBER	ULTIMATE TENSILE STRENGTH psi	0.2% YIELD STRENGTH psi	PER CENT ELONGATION in 1"	PER CENT REDUCTION of AREA
& 36-57	194,400	168,000	13.5	40.8
& 36-58	202,400	170,400	12.5	28.0
& 36-59	192,800	160,400	12.0	39.0
& 36-60	198,000	162,400	13.5	40.0

All test bars were investment cast and heat treated as follows:
Solution Annealed: 1900°F.-30 min.—oil quench (Rc 33-34)
Aged: 900°F.-2 hours—air cooled (Rc 45-46)

The outstanding properties of our 17-4PH are an example of the superiority of *Rx*MET® alloys made with T^{n}CP.

For your casting alloy requirements, tons or pounds, standard or special, call on the leader in master alloy production.

T^{n}CP—a symbol for our own alloy refining developments. It means:

The nearly Complete Protection.

WAI MET ALLOYS CO.

1999 GUOIN STREET
DETROIT 7, MICHIGAN

TOOL STEELS • STAINLESS STEELS
SUPERALLOYS • VACUUM-MELTED ALLOYS

Circle No. 79 on Reader Service Card

If your plant is in this area...

DOLLIN DIE-CASTING

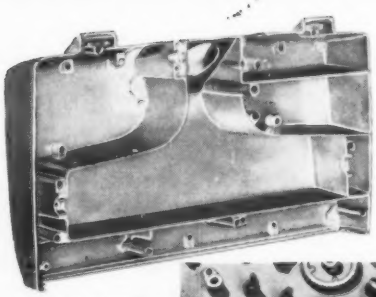
- Service
- Quality
- Economy

are as close as our local representative

When you have a die-casting design problem—a part for discussion—a print for quotation, call in your local DOLLIN representative. He can give you on-the-spot help and place at your service the vast experience and facilities of the DOLLIN engineering staff and plant to supply the most practical, economical answer.

DOLLIN die-casting service is comprehensive and complete. It includes engineering assistance . . . big, modern plant . . . die-making . . . high-production equipment . . . rigid inspection . . . dependable delivery.

Submit prints or samples of parts for engineering advice and quotation, without obligation. Write for 16-page brochure showing DOLLIN facilities and services.



LARGE PARTS to "Midget" Parts

DOLLIN CORPORATION
614 So. 21st., Irvington 11, N. J.

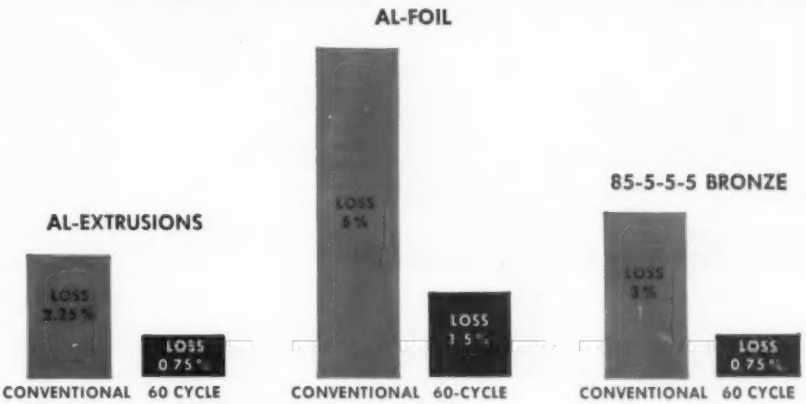
DOLLIN CORPORATION 25th ANNIVERSARY 1934-1959 Die-Castings

DOLLIN Zinc & Aluminum DIE-CASTINGS

Circle No. 29 on Reader Service Card

60 CYCLE INDUCTION MELTING *SAVES* Metal and Money

METAL LOSS REDUCED



A sharp cut in metal losses is inherent in 60 CYCLE INDUCTION MELTING. Unnecessary metal losses in a furnace can amount to many thousands of dollars per year. Here are three examples of what AJAX 60 CYCLE INDUCTION furnaces have done for others:

ALUMINUM EXTRUDERS: Typical experience of manufacturers of aluminum extrusion billets using AJAX-TAMA-WYATT 60 CYCLE INDUCTION furnaces is a metal loss of 0.75% as compared to 2.25% in conventional fuel fired furnaces. (Based on a charge containing 30-40% extrusion scrap.)

ALUMINUM FOIL MILLS: 60 CYCLE INDUCTION MELTING furnaces are widely used to melt foil scrap and other finely divided materials. Operating reports show a reduction from 6% metal loss in conventional furnaces to 1½ % in the coreless AJAX-JUNKER furnace.

BRASS AND BRONZE FOUNDRIES: AJAX melting furnaces are standard in all brass millcasting shops, because metal losses with other methods are prohibitive. More recently, special AJAX-TAMA-WYATT furnaces have been applied widely to 85-5-5-5 bronze casting. Here the metal loss is under 1%, as compared to 3% or more in externally heated furnaces.

IN ALL THESE CASES, SAVINGS PAID FOR THE EQUIPMENT IN LESS THAN TWO YEARS.

60 CYCLE INDUCTION MELTING has many other important advantages. Our engineers will be glad to analyze your requirements. Please write to AJAX ENGINEERING DIVISION, P. O. Box 1418, Trenton 7, N. J.

VISIT OUR BOOTH NO. 1506 AT THE METAL SHOW

Induction Heating is our ONLY Business

Ajax Magnethermic CORPORATION

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MAGNETHERMIC DIVISION
P.O. Box 839 • 3990 Simon Road
Youngstown 1, Ohio

AJAX ENGINEERING DIVISION
P.O. Box 1418 • Lalor & Hancock Streets
Trenton 7, New Jersey

Circle No. 2 on Reader Service Card

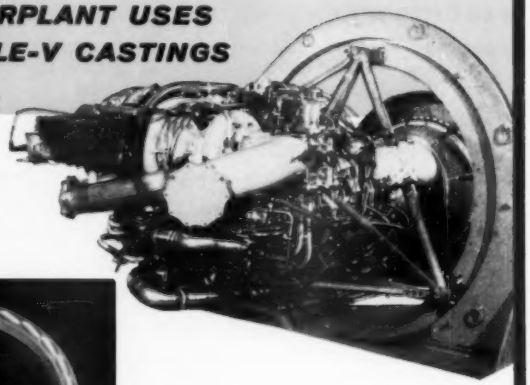
METAL SHOW EXHIBITORS

Here's a partial list of exhibitors at the 41st National Metal Exposition and Congress being held in Chicago, November 2-6. This list is limited to those exhibits of probable interest to PMM readers.

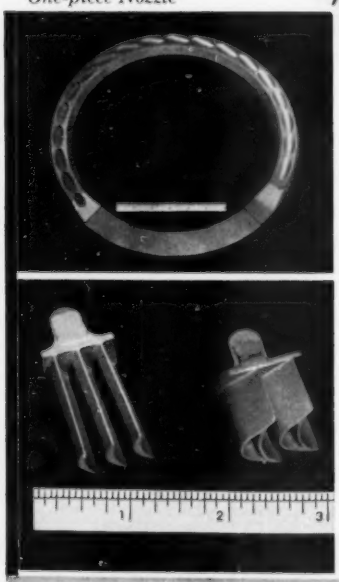
Booth	Company
	A
1298	Adolph Plating, Inc.
1526	Ajax Electric Co.
1506	Ajax Engineering Div.
1506	Ajax-Magnethermic Corp.
1212	Allied Research Products, Inc.
727	American Brake Shoe Co.
1751	American Sealants Co.
1745	Amplex Div.
1461	Anderson Brothers Mfg. Co.
1550	Atlas Press Co.
	B
528	Babcock & Wilcox Co.
1455	Barber-Colman Co.
1636	Beryllium Corp.
1541	Binks Manufacturing Co.
1641	Blakeslee & Co., G.S.
1463	British Industries Corp.
205	Brush Beryllium Co.
	C
1597	Chicago Powdered Metal Products Co.
1615	Cromalloy Corp.
1868	Chromizing Co.
1745	Chrysler Corp.
1468	Consolidated Electrodynamics Corp.
1730	Curtiss-Wright Corp.
	D
1219	Detrex Chemical Industries, Inc.
634	DeVilbiss Co.
1846	DeWalt Div.
1369	Dixon Crucible Co., Joseph
1047	Dow Chemical Co.
	E
1135	Electric Furnace Co.
1516	Elox Corp. of Michigan
1430	Engelhard Chemical Div.
1430	Engelhard Industries, Inc.
	F
948	Fiske Brothers Refining Co.
1340	Foxboro Co.
	G
548	General Alloys Co.
1019	Gries Reproducer Corp.
	H
1053	Haller, Inc.
1027	Harper Electric Furnace Corp.
527	Haynes-Stellite Div.
1559	Heli-Coil Corp.
1605	Hevi-Duty Electric Co.
1356	High Vacuum Equipment Corp.
1735	Hitchiner Manufacturing Co., Inc.
1406	Houghton & Co., E. F.
	I
1555	Industrial Publishing Corp.
553	Ipsen Industries, Inc.
	K
736	Kemp Manufacturing Co., C. M.
1819	Kinney Manufacturing Div.
1570	Kux Machine Co.
	L
1654	Lake Erie Machinery Corp.
1350	Latrobe Steel Co.
836	Leeds & Northrup Co.
1807	Lepel High Frequency Laboratories, Inc.
520	Lindberg Engineering Co.
	M
865	Magnaflux Corp.
1867	Mannesmann-Meer, Inc.
533	Metal Powder Industries Federation
	N
1227	NRC Equipment Corp.
1819	New York Air Brake Co.
	O
1036	Oakite Products, Inc.
1530	Ohio Crankshaft Co.
	P
742	Perfection Industries Div.
1555	Power Transmission Design
943	Precision Extrusions, Inc.
1555	Precision Metal Molding
844	Pressco Casting & Mfg. Corp.
1725	Pyrometer Instrument Co.
	R
1250	Ransburg Electo-Coating Corp.
	S
720	Selas Corp. of America
1463	Shaw Process Development Corp.
1366	Socony Mobil Oil Co., Inc.
542	Stokes Corp., F. J.
648	Surface Combustion Corp.
	T
1724	Turco Products, Inc.
	U
527	Union Carbide Corp.
527	Union Carbide Metals Co.
1660	United States Gypsum Co.
1656	Universal Castings Corp.
	V
536	Vanadium-Alloys Steel Co.
	W
1560	Wah Chang Corp.
1750	Walker-Turner Div.
1555	Welding Design and Fabrication
1715	West Instrument Corp.
1630	Westinghouse Electric Corp.
1536	Wheelabrator Corp.
1455	Wheelco Instruments Div.

Misco RIDES WITH THE X-15!

POWERPLANT USES DOUBLE-V CASTINGS



One-piece Nozzle



Two rotor blade segments, one with two blades, and one with three blades, produced by Misco's DOUBLE-V (Vacuum Melt and Vacuum Cast) System, of Udimet 500; and a one-piece cast nozzle of stainless steel, — are used in the turbo-pump of the X-15 powerplant. These castings were supplied to Reaction Motors Division of Thiokol Chemical Corporation. *Send us your inquiries and details of your requirements.*

Rotor Blade Segments

Misco Precision Casting Company

Plants in WHITEHALL, MICHIGAN MUSKEGON, MICHIGAN

MISCO

Address inquiries to 122 Gibbs St. WHITEHALL, MICHIGAN Whitehall 2-1515

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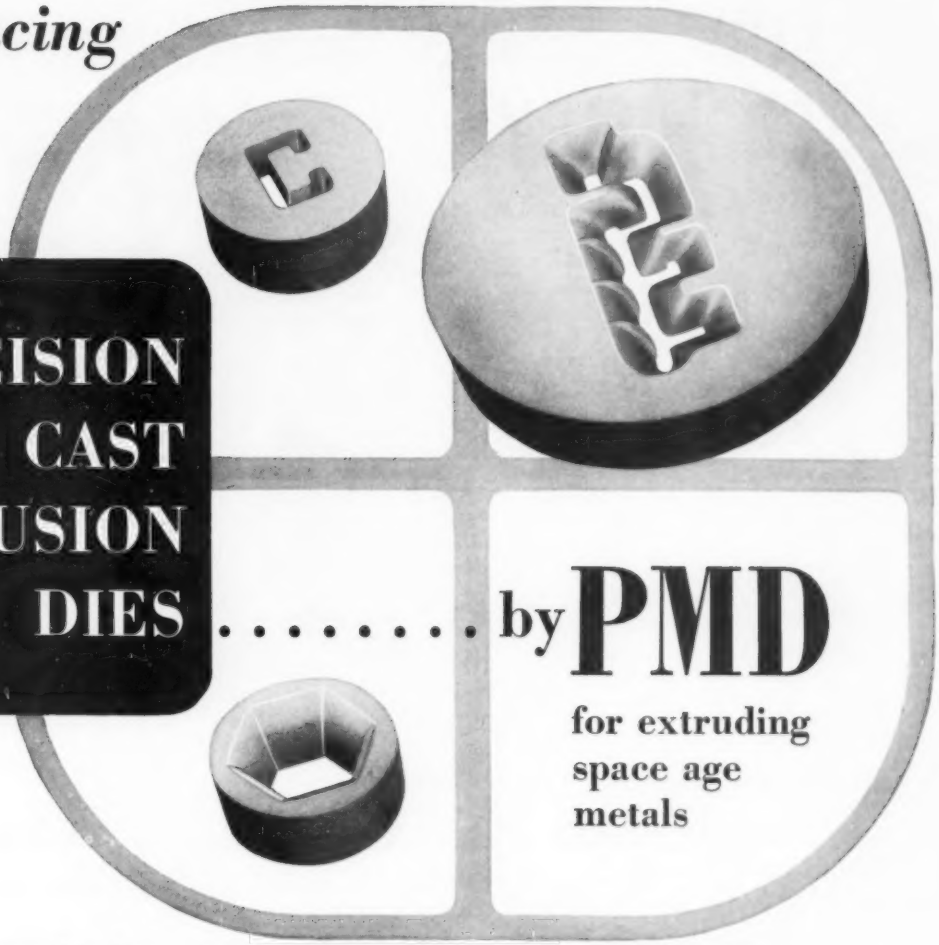
PRODUCERS OF AIRCRAFT AND INDUSTRIAL INVESTMENT CASTINGS

Circle No. 56 on Reader Service Card

Announcing

PRECISION CAST EXTRUSION DIES ..... by PMD



for extruding space age metals

NOW, in our own Shaw Process foundry, PMD is producing precision cast dies for extruding the new space-age metals such as titanium and A286 stainless steel, as well as copper base alloys and steel alloys.

These and other hard-to-work alloys can now be extruded at temperatures of up to 2,200°F with dies precision cast by PMD in alloys such as the chromium and tungsten hot-work steels, tungsten and molybdenum high-speed steels, and cobalt base alloys.

Extruders of these tough metals report closer tolerances, longer die life, superior die performance, and trouble-free operation with precision cast extrusion dies by PMD. These high temperature dies are designed and produced to the same high standards of craftsmanship that have made PMD the symbol of quality and dependability in aluminum extrusion dies.

PMD has the men, machines and experience to solve your difficult extrusion die problems.

PMD SERVICES FOR EXTRUDERS AND DIE CASTERS

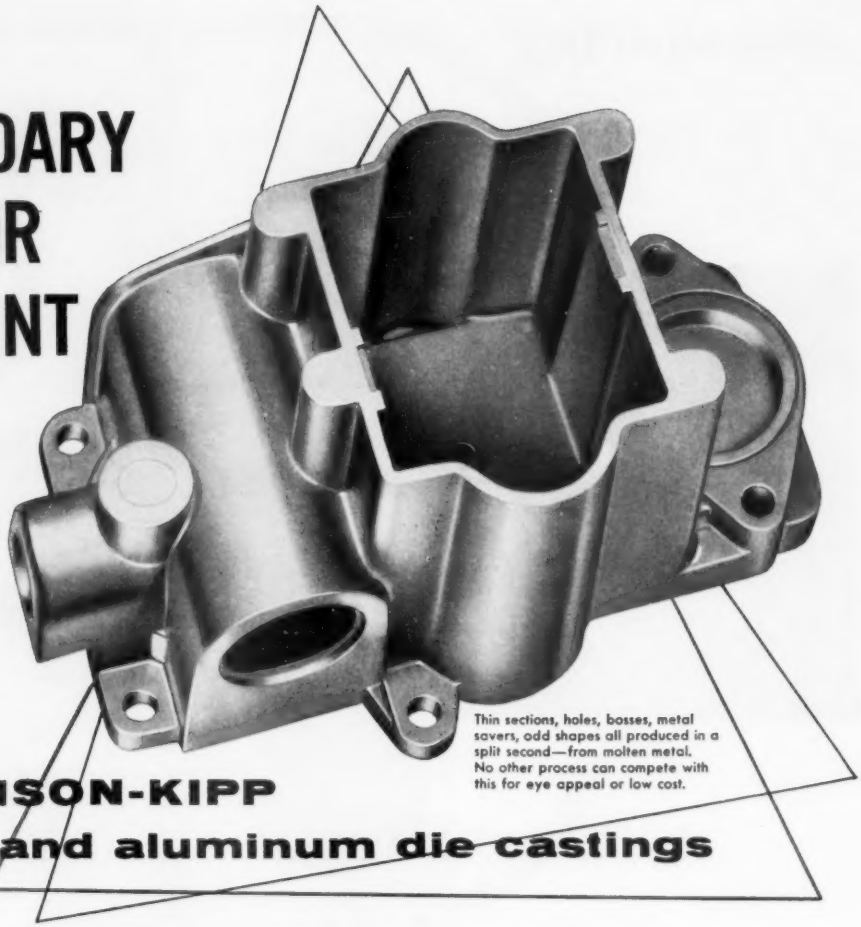
- **Extrusion Dies & Tools**
- **Die Casting Dies**
- **Permanent Molds**
- **D.C. Billet Casting Units**
- **Billet Molds**
- **Extrusion Plant Materials Handling Equipment**

PMD EXTRUSION DIE COMPANY, INC.

5747 BEEBE STREET, WARREN, MICHIGAN • PHONE: COngress 4-2518 (*Detroit*)

Circle No. 61 on Reader Service Card

LOW SECONDARY LABOR CONTENT



Thin sections, holes, bosses, metal savers, odd shapes all produced in a split second—from molten metal. No other process can compete with this for eye appeal or low cost.

with MADISON-KIPP zinc and aluminum die castings

When product designers send preliminary drawings for critical review by the seasoned Madison-Kipp mechanics, it has often proved to be the decisive factor in the ultimate design of the component parts.

The original designer thoroughly understands the function of his product. We thoroughly understand die casting and machining problems. Combining the two skills at an early period of development is logical and valuable.

Our customers of long standing always utilize this system which virtually pyramids design talent for successful high production manufacturing, with low secondary labor content.

Please clip this ad as a reminder to contact us when you have die casting requirements.

kipp

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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characteristics-controlled

AMCO NON-FERROUS METAL POWDERS

help you

CONTROL QUALITY OF SINTERED PARTS

You can predict the properties of your sinterings with increased confidence when you use AMCO Non-Ferrous Metal Powders! Here's why: The characteristics of every AMCO powder are rigorously controlled from careful selection of the basic metal straight through contamination-free packaging. Characteristics-control assures you of *purity, uniformity, stability.*

COPPER—Electrolytic . . . in a wide range of analyses, densities, and sizes.

COPPER ALLOY—Prealloyed . . . including bronze filter powders of highly predictable permeability.

TIN—Jet-atomized . . . custom screened and blended to various specifications.

SOLDER—High apparent density . . . seven analyses in both standard and fine sizes.

SILVER—Electrolytic . . . with a minimum purity of 99.5%.

Free Technical Data and Aid. Ask for Handbook C-14, "AMCO Metal Powders." Also available without charge is the assistance of Technical Service Representatives. Please contact the Specialty Metal Sales Department.

AMCO DIVISION
American Metal Climax, Inc.
61 Broadway, New York 6, N. Y.

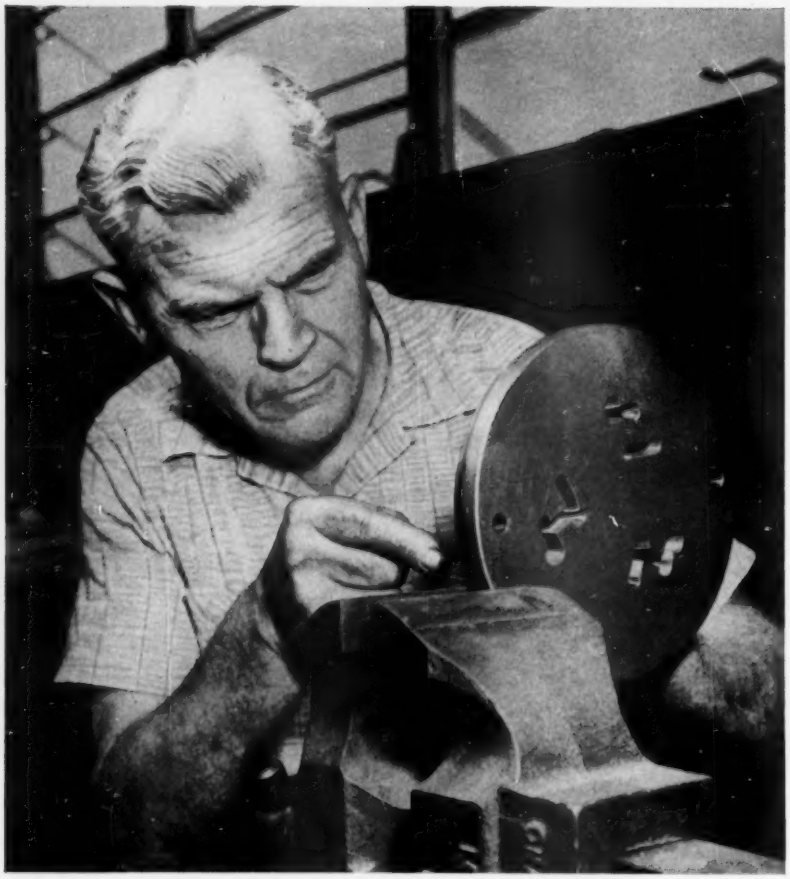
Sales Offices: DETROIT / LOS ANGELES / CHICAGO

Circle No. 6 on Reader Service Card

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Making "3-in. edge" extrusions with die of Cromo-WV

A manufacturer in the Southeast needed a long wearing hot-work tool steel to produce a "3-in. edge" extrusion made of aluminum. They talked it over with our local tool steel distributor who recommended making the die from a Bethlehem Cromo-WV upset-forged disc.

It was a good choice. The disc machined readily, and was easy to heat-treat. Hardened to Rockwell C47, the die extrudes 24 billets per hour, with brief stops for polishing. The life of the die is about 50,000 lb of extruded metal.

Cromo-WV, with its 5 pct chrome content, plus .30 pct vanadium, is a modification of our popular Cromo-W, the original 5 pct chrome hot-work steel. Resistant to heat checking, Cromo-WV also has good red hardness, and good shock resistance.

Like to give Cromo-WV a try? Just call your Bethlehem tool steel distributor. You'll find he will handle your request promptly.

Circle No. 14 on Reader Service Card

BETHLEHEM TOOL STEEL ENGINEER SAYS:

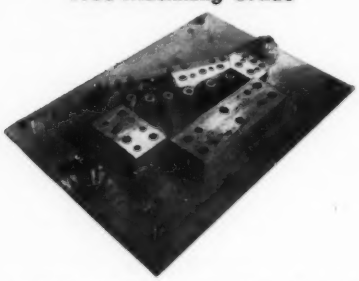
Drilled Holes Are Not Round (Usually)

Round holes which are drilled in tool steel stock with twist drills, if measured accurately, are usually found to be: 1. out of round; 2. oversize (compared with drill diameter); and 3. tapered throughout their depth. In other words a half-inch-diameter hole cannot be drilled with a half-inch-diameter drill.

This condition results largely from mechanical "play" in the drilling equipment, although many other factors can exert considerable influence. For example, if the two ground lips which form the cutting edges of a twist drill are unequal in length, the drill will produce holes of irregular size and shape.

The production of parts containing accurate round holes is most commonly accomplished by rough-drilling the holes undersize, and then either reaming or broaching to obtain the desired size.

Bethlehem Air-4 Is an Ideal Free-Machining Grade



Air-4, Bethlehem's new medium alloy tool steel, is an ideal free-machining grade due to the addition of lead. It hardens in air at 1525F to 1575F, and provides excellent wear and high toughness. Air-4 is also a deep-hardening grade, with high compressive strength. Order it today from your Bethlehem tool steel distributor.

ACHESON

dispersions digest

Reporting uses for

dag® BRAND DISPERSIONS

COLLOIDAL DISPERSIONS OF GRAPHITE, MOLYBDENUM DISULFIDE, AND OTHER SOLIDS

'dag' and 'Prodag' are trademarks registered in the U. S. Patent Office by Acheson Industries, Inc.

MUELLER BRASS SAVES $15,000 A YEAR ON FORGING LUBRICATION

Efficiencies realized by just one company — with the help of Acheson Dispersions — have already added up to this substantial savings. Uniform coverage, easy sprayability, and lasting lubrication effectiveness are providing this leading forgings producer: longer die life, increased production, fewer rejects, and improved forgings. This lubricating success story is being repeated throughout the metal working industry. Possibly *you* could profit from the use of an Acheson Dispersion.

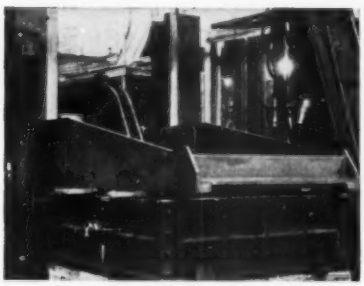
'Prodag' application on forging presses at Mueller Brass Company has saved between $15,000 and $17,000 annually for the past fifteen years. These impressive savings earned by this Port Huron, Michigan company — the world's largest producer of brass and bronze forgings — have been realized in many areas.

Previously, crank forging pressmen at Mueller swabbed the dies between each press stroke. Mueller designed their own spray apparatus, both manual and automatic, to lubricate lower and upper dies simultaneously. Time studies have shown that spraying has effected a five percent-per-pound economy over the swab method.

Spray application of 'Prodag' at Mueller Brass Company has resulted in impressive production savings.

Even more importantly, by using Acheson's 'Prodag' — a dispersion of graphite and water — diluted 1:35, Mueller has gained longer die life, reduced the percentage of scrap loss, and has obtained a better finish on their forgings. According to Mr. O. M. Hanton, Chief Forging Engineer for Mueller, "with 'Prodag' we get the right amount of lubricant on the die. Swabbing resulted in too much lubrication at one place or another in the die cavity, resulting in either a ruptured die or a defective part. Previously, every forging produced had to go to the grinding department. And grinding is one of the most expensive operations in a forge shop."

In producing deep-cavity forgings, or products which demand much smaller tolerances, Mueller uses 'dag' No. 3 — another of Acheson's graphite-water base dispersions. If you have a forging lubrication problem it will pay you to call in your Acheson Service Engineer or write for Bulletin No. 426.



'dag' 35, brush-applied to the slides of this rollover machine, increases machine life for this midwest foundry.

An expensive foundry problem was solved for the D. J. Murray Manufacturing Company, Wausau, Wisconsin, with the use of Acheson's 'dag' 35 — colloidal graphite in an alkyd resin solution. Slides on the huge rollover machine installed in their foundry division, previously lubricated by first a dry graphite and then rosin, were becoming deeply scored as a result of its 90-cycle-a-day operation in the handling of bench and floor molds.

The scoring and machine vibration was so severe that according to Maintenance Foreman, Ben Sayles, "we could see that the life of the machine was going to be very short if we continued this method of lubrication." Coating the slides daily with 'dag' 35, improved machine operation immediately. The scoring all but disappeared. After two years of application with this Acheson dispersion, no repairs have been necessary and none are foreseen. Since the entire production of their grey iron sand slinger line — some 60 tons of material in 8 hours — goes through this machine, the downtime avoided represents an important savings to the company.

For additional information, write for Acheson Bulletin No. 425. Address Dept. PMM-119.

ACHESON *Colloids Company*

PORT HURON, MICHIGAN

A division of Acheson Industries, Inc.

Also Acheson Industries (Europe) Ltd. and affiliates, London, England

Offices in: Boston • Chicago • Cleveland • Dayton • Detroit • Los Angeles • Milwaukee New York • Philadelphia • Pittsburgh • Rochester • St. Louis

Circle No. 1 on Reader Service Card

NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

ALUMINUM WHEELS MARK NEW AUTOMOTIVE USE

Another step forward in the growing use of aluminum by the automotive industry was marked by Pontiac's adoption of aluminum wheels with integral hub and brake drum as optional equipment on its 1960 models.

The aluminum wheel design was developed by KAISER ALUMINUM in 1954. Prototype models were tested in 1955 and 1956, both in the laboratory and on test tracks, before the wheel was publicly displayed at a meeting of the Society of Automotive Engineers in 1957.

The tests showed the integral aluminum wheels surpassed accepted standards for durability and brake performance, with substantial reduction in brake fade achieved by rapid heat dissipation from the braking surface.

KELSEY-HAYES will produce the wheels for Pontiac.

Editors Note: A complete report on these aluminum wheels will be published soon in PRECISION METAL MOLDING.

SERVES BRASS ASSOC.

MARVEL

David T. Marvel, vice president for brass sales at the METALS DIV., OLIN MATHIESON CHEMICAL CORP., has been named the division's representative to the COPPER & BRASS RESEARCH ASSOCIATION. In his advisory capacity, Marvel will serve as a vice president and director of the association.

GUYATT JOINS REYNOLDS

GUYATT

Cecil W. Guyatt has joined REYNOLDS METALS CO. as chief industrial engineer. Formerly chief industrial engineer in charge of methods at U. S. STEEL CORP., Guyatt helped pioneer industrial engineering there 24 years ago.

Reynolds' vice president of operations, W. Monroe Wells, says, "Aluminum is rapidly becoming a mass production industry, with larger orders and longer production runs for various products. Much of the production equipment and methods used for aluminum are now comparable to those in the steel industry. Mr. Guyatt's extensive experience in industrial engineering in the steel industry will be of great value to our company in its continuous efforts to devise better manufacturing methods and reduce costs."

DR. LONG HEADS AIME'S METALLURGICAL SOCIETY

Dr. Carleton C. Long, director of research at ST. JOSEPH LEAD CO. has been elected president of THE METALLURGICAL SOCIETY of the AMERICAN INSTITUTE OF MINING, METALLURGICAL, AND PETROLEUM ENGINEERS. He will take office during the Institute's annual meeting in New York, February 14-18.

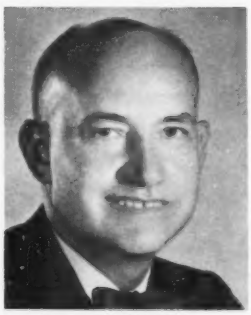
Dr. Long will succeed Dr. John Chipman, head of the Dept. of Metallurgy, Massachusetts Institute of Technology.

POWDER METALLURGY CONFERENCE SET

The 1960 International Conference on Powder Metallurgy will be held June 13-15 at the Hotel Biltmore in New York. Its purpose will be to provide an evaluation of the present status of powder metallurgy and its part in today's advanced technology.

The conference is sponsored jointly by the METAL POWDER INDUSTRIES FEDERATION and the POWDER METALLURGY COMMITTEE of THE METALLURGICAL SOCIETY, AMERICAN INSTITUTE OF MINING, METALLURGICAL, AND PETROLEUM ENGINEERS. For the two days following the conference, tours will be organized among plants of powder producers, powder metallurgy parts manufacturers, and compacting press and sintering furnace manufacturers.

CADIEUX IS PRESIDENT OF CASTING ENGINEERS

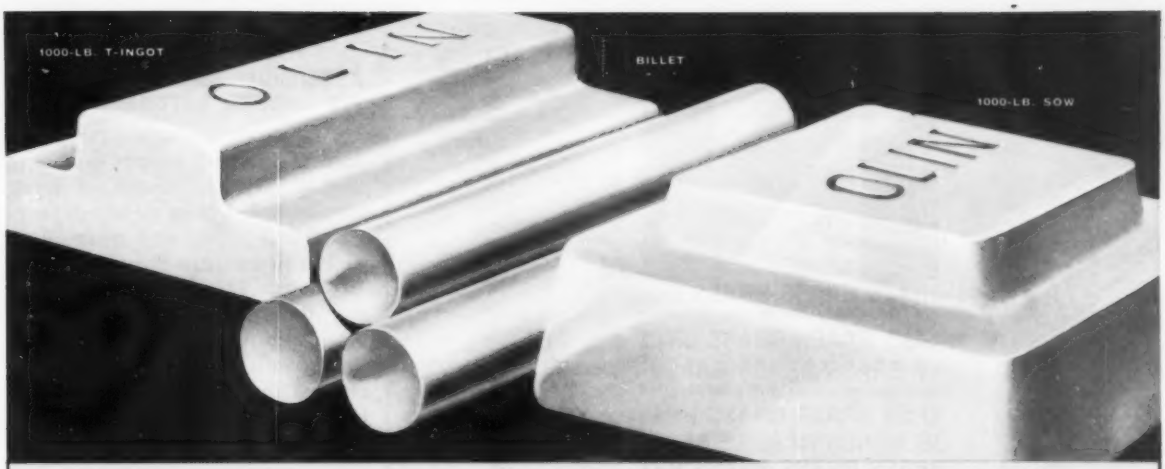


CADIEUX

Joseph H. Cadieux has been named president of CASTING ENGINEERS, a division of CONSOLIDATED FOUNDRIES & MFG. CORP. Vice president for the past two years, Cadieux formerly was vice president, manufacturing, for Misco Precision Casting Co.

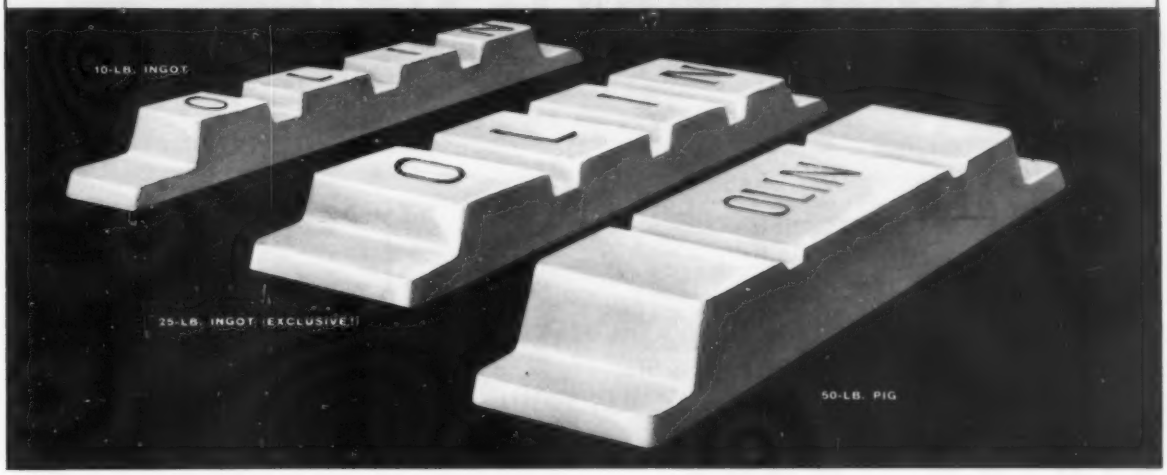
R. D. Colburn, Consolidated president, also announced that Casting Engineers is now completely independent of Misco, and will continue to concentrate on industrial and commercial markets.

continued



There's one for your every need

OLIN ALUMINUM PIG, INGOT AND BILLET



FOR EXTRUDERS

Pure pig in 50 and 1000 lb. sizes. **T-Ingot** in 1000 and 1500 lb. sizes. **Billet,** direct chill cast, in standard alloys, diameters and lengths, including log form. (Billet stock is supplied in special bundles to facilitate shipping and handling in your plant.)

FOR FOUNDRIES

Alloy pig and ingot, in standard alloys, in 10, 25 and 50 lb. sizes. (10 and 25 pounders offer exclusive benefits: smaller size to increase handling efficiency and speed melting; deep notches for easier breaking; 4-section design with smaller sections for faster crucible charging.)

FOR OTHERS

Pure pig, rotor ingot, custom alloys for special applications

You know what you're getting in Olin Aluminum. For this is primary metal—clean, uniform and with quality controlled by the most advanced techniques. So for dependable deliveries of pig, ingot or billet—call the Olin Aluminum Sales Office or distributor in your area.

SEE EDWARD R. MURROW ON "SMALL WORLD"—EVERY SUN. EVE., CBS-TV

OLIN ALUMINUM

OLIN MATHIESON • METALS DIVISION • 400 PARK AVE. • NEW YORK 22, N. Y.

Circle No. 59 on Reader Service Card

SINTER BRASS COMPACTS IN NITROGEN

with lithium stearate

Recent research indicates improved physicals for brass compacts using lithium stearate as a lubricant and nitrogen as the sintering atmosphere.

Typical results promise 20% stronger, 100% more ductile parts as well as safer, more economical sintering operations.

TRY IT NOW YOURSELF!

All you need is a special powder metallurgy grade lithium stearate (fluffy) available only from us. We'll send you complete facts and lubricant samples on letterhead request. Foote Mineral Company, 474 18 West Chelten Bldg., Phila. 44, Pa.

FOOTE MINERAL COMPANY

Circle No. 37 on Reader Service Card

ALUMINUM SMELTERS SEE HIGHER RETURN

THE ALUMINUM SMELTERS RESEARCH INSTITUTE reports that more than 7 billion pounds of scrap aluminum has been salvaged, processed into alloys, and returned to American industry during the past 10 years. The Institute predicts that, through expanding knowledge of metallurgy, more than 15 billion pounds will be returned to the nation's aluminum users during the next 10 years.

SHAW NAMES PAGET

PAGET

Geoffrey Paget has been appointed chief metallurgist for the SHAW PROCESS DEVELOPMENT CORP., a subsidiary of BRITISH INDUSTRIES CORP. and sole licensor for the Shaw Process of precision casting.

BURGESS-NORTON BUYS MORE LAND, BUILDINGS

To meet growing production needs, BURGESS-NORTON MFG. CO. has purchased industrial buildings located on 24 acres in Geneva, Ill. The added facilities, which will be used for manufacturing only, were needed because of increasing demands for sintered metal parts, cold extruded metal parts, crushed tungsten carbide abrasives, and brazed assemblies.

Burgess-Nortion is conducting development work on these parts in an effort to combine one or more of the newer techniques or processes with one another, or with older production methods. These developments may result in products of a revolutionary concept.

continued on page 34

DOW | METAL PRODUCTS

ANNOUNCING

a new die casting plant for light metals

(another step forward in Dow's expansion program in metals)

We're proud to announce that a new Dow die casting plant for aluminum and magnesium is now open for business. We're sure you'll be keenly interested in this modern facility equipped to give you every production advantage.

Equipment utilizes the latest developments in die casting technology. The new plant layout is carefully planned to achieve top efficiency from ingot to finished casting.

Our new plant is fully staffed with skilled, experienced personnel who are specialists in die casting light metals. And, of course, it's backed by forty years of Dow experience in magnesium. Dow experts are ready to help you realize the full advantages inherent in the die casting process.

You can find out all about it by contacting the Dow sales office near you. You'll be getting an introduction to a new dependable production source that meets your deadlines with quality die castings—and economy, too!

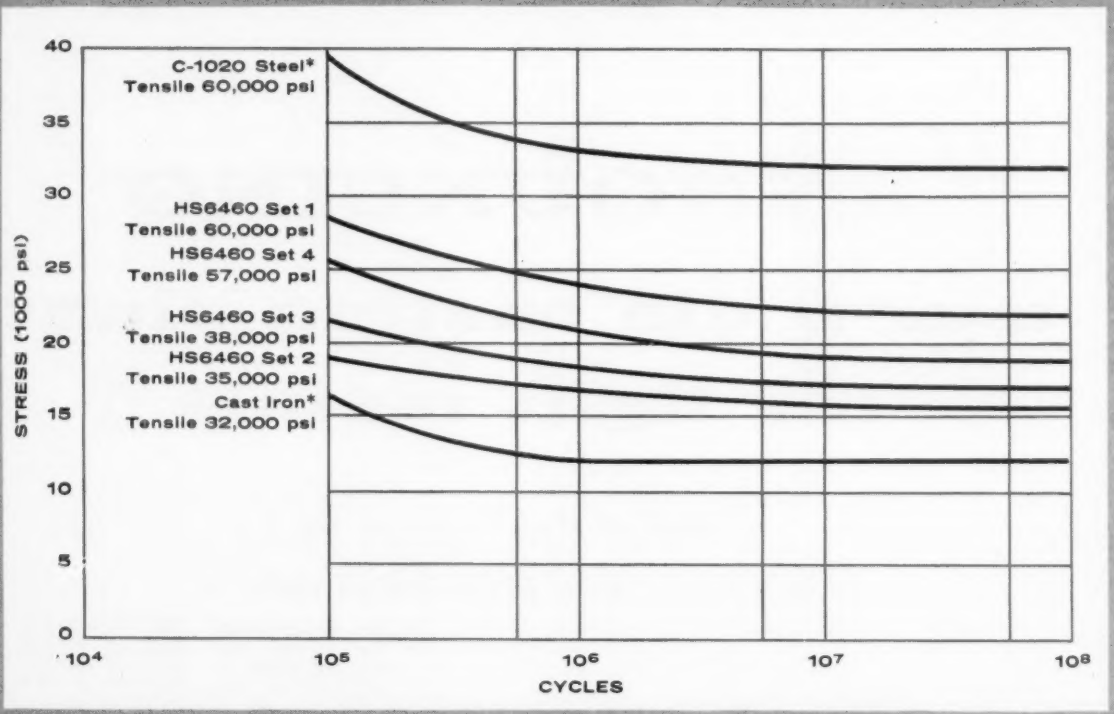
THE DOW METAL PRODUCTS COMPANY

DIVISION OF THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

Circle No. 31 on Reader Service Card

Consolidated Fatigue Test Data on Republic HS6460 High Strength Powder compared with C-1020 Steel and Cast Iron



REPUBLIC PROGRESS REPORT

to DESIGNERS METALLURGISTS ENGINEERS

Procedure Used to Obtain Test Results

Material—Type HS6460 with 1% zinc stearate. Single press and sintered blank machined to standard A.S.T.M. Fatigue Bar—.300″ dia. Testing machine—R. R. Moore Rotating Beam.

Sintering conditions for Set 1—Endothermic atmosphere, dew point +30°F, 2050°F, 45 minutes at heat (extended time because of size). Briquetting pressure—100,000 psi. Density—6.83. Combined carbon 0.20%.

Sintering conditions for Set 2—Hydrogen atmosphere, 2050°F, 45 minutes at heat. Briquetting pressure—80,000 psi. Density—6.76. No carbon added.

Sintering conditions for Set 3—Endothermic atmosphere, dew point +30°F, 2050°F, 45 minutes at heat (extended time because of size). Briquetting pressure—60,000 psi. Density—6.36. Combined carbon 0.20%.

Sintering conditions for Set 4—Endothermic atmosphere, dew point +30°F, 2050°F, 45 minutes at heat (extended time because of size). Briquetting pressure—80,000 psi. Density—6.67. Combined carbon 0.20%.

*Data on C-1020 hot rolled steel and cast iron obtained from ASM Handbook, 1948 Edition, Page 119.

For more information, write Republic Steel, Dept. PM-8576, 1441 Republic Building, Cleveland 1, Ohio.

Preliminary Impact Test Data on Type HS6460 High Strength Powder

SET 1—COMBINED CARBON 0.20%

BRIQUETTING PRESSURE	SINTERED DENSITY	NOTCHED IMPACT STRENGTH	UNNOTCHED IMPACT STRENGTH
60,000	6.33	15 in-lb	63 in-lb
80,000	6.68	22 in-lb	105 in-lb
100,000	6.83	25 in-lb	130 in-lb

SET 2—NO CARBON ADDED

60,000	6.42	22 in-lb	101 in-lb
80,000	6.78	35 in-lb	166 in-lb
100,000	6.96	43 in-lb	200 in-lb+*

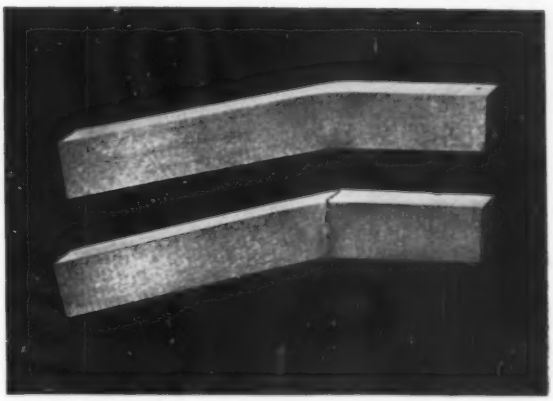
*(value exceeded capacity of impact tester)

Procedure Used to Obtain Impact Test Results

Material—Type HS6460 with 1% zinc stearate. Single press and sintered standard Izod Bars. Sintering conditions for set 1—Endothermic atmosphere, dew point +30°F, 2050°F, 45 minutes at heat (extended time because of size).

Sintering conditions for set 2—Hydrogen atmosphere, 2050°F, 45 minutes at heat.

FREE BOOK—Properties of Republic Type HS6460. This preliminary information illustrates the performance of a typical lot of HS6460, the powder especially developed by Republic to provide excellent carbon compatibility for higher stressed structural parts—plus the advantage of excellent heat treat response. Write Republic Steel, Dept. PM-8576, 1441 Republic Building, Cleveland 1, Ohio, for your copy. Ask for ADV. 1028.



Photograph shows single press and sintered Izod Bars after impact testing at 200 in-lb+. Bars did not break.

REPUBLIC STEEL

GENERAL OFFICES • CLEVELAND 1, OHIO

World's Widest Range of Standard Steels and Steel Products

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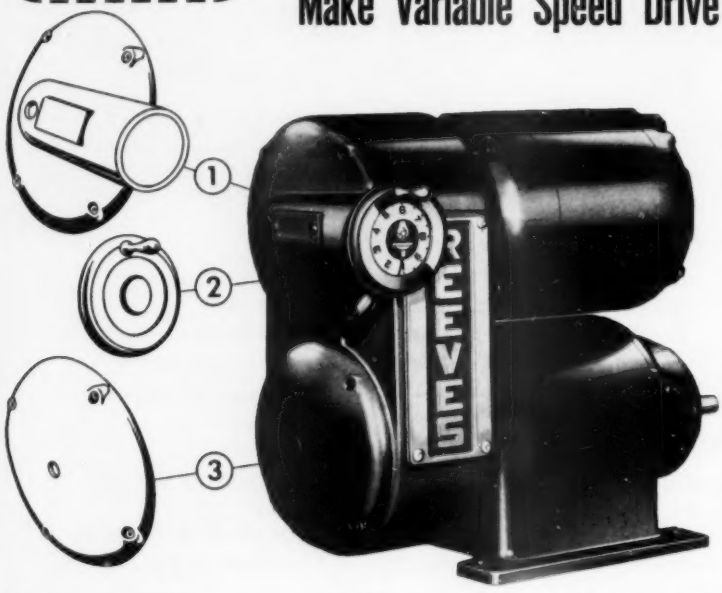
Paramount
Die Castings
AT WORK
No. 1 of a Series.

Paramount Die Castings Helps Reeves Pulley Co. Make Variable Speed Drive



The three castings above are supplied by Paramount to Reeves Pulley Company for the end shields and dial wheel on the Reeves Motodrive.

Size 100 Reeves fractional hp. Vari-Speed Motodrive with infinite variable output speed from 2.86 to 4660 rpm. Size 100 is one of a full line of Reeves Motodrives for speed control on ¼ hp. through 40 hp.

Paramount can help solve your design and production problems.

If there's a die casting in your product, it will pay you to investigate the complete die casting service available at Paramount Die Castings Co. Paramount's designers, sales engineers, plus modern tooling and production facilities offer you an ideal source for all your die casting requirements.

Zinc, Aluminum and Magnesium Die Castings

Paramount has extensive facilities for the production of die castings from all three . . . Zinc, Aluminum and Magnesium. And, Paramount is set up to handle the whole job, from blue print to machined, finished or plated part . . . offering an integrated time and cost-saving service to manufacturers in a wide variety of industries.

Three complete plants . . .
two in St. Joseph, Michigan,
one in Seymour, Indiana

SEND FOR THIS HELPFUL BROCHURE . . .

For your files, a brief guide to Designing for Die Castings and a visit to Paramount.

P Paramount DIE CASTING CO.
A Subsidiary of Talon, Inc. ST. JOSEPH, MICHIGAN
Circle No. 60 on Reader Service Card

ICI ANNOUNCES DATES FOR ANNUAL MEETING

The INVESTMENT CASTING INSTITUTE's Seventh Annual Meeting will be held at the La Salle Hotel in Chicago on November 3 and 4. Among topics to be discussed will be current research developments.

Paul Gouwens, supervisor of foundry research at Armour Research Foundation, will speak on high thermo conductivity molds, vibratory energy effects on solidification, grain size control through innoculation, and grain refinements through shear energy influence.

T. E. Millard of General Electric Co. will give an appraisal of the current status of the ceramic shell. His comments will be followed by a panel critique of the shell process moderated by Dr. N. J. Grant, with a panel of industry experts.

STOKES EXPANDS AGAIN

Another expansion of F. J. STOKES CORP.'s production and engineering facilities in Philadelphia has been started. The third major expansion in the last eight years, a 50,000-square-foot addition to the present plant should be completed by the middle of next year.

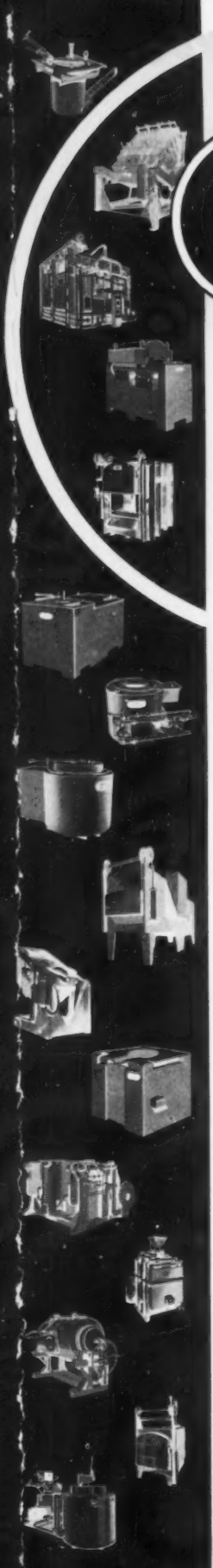
The new facilities will increase the firm's manufacturing and assembly capacity by about 20 percent, and will provide more space for product design, sales engineering, and technical service.

PEERLESS GEAR EXPANDS

PEERLESS GEAR & MACHINE CO., INC. has expanded its operations by moving to a new and enlarged plant in Dunkirk, Ohio. Located approximately two miles from their previous location, the new plant has 25,000 square feet of manufacturing space. The firm manufactures Peerless "Flame-a-loy" racks and pinions for the die casting industry.

ALLEN-STEVENS EXPANDS

ALLEN-STEVENS CORP. is building a 20,000-square-foot addition to its die casting plant in Woodside, N. Y. Included is an air-conditioned mechanical laboratory which will house an optical comparator, Rockwell hardness tester, tensile strength tester, and other precision instruments and gauges.



LINDBERG
FISHER

This nameplate is on all the equipment anyone needs for melting and holding aluminum

Heat and aluminum have been Lindberg's babies for many years. If your product requires the application of heat to aluminum anywhere along the line, we can help you do the job. Lindberg-Fisher furnaces cover every requirement of "heat for aluminum" and embody the latest developments in the field. Many new design and engineering features make Lindberg-Fisher melting and holding furnaces, and accessories, the most modern equipment available to industry.

With Lindberg-Fisher furnaces too, you get the expert technical skills of Lindberg Engineering Company's staff of engineers, metallurgists, technicians, widely experienced in all phases of aluminum melting, casting and treating. Because Lindberg builds all kinds of melting equipment, gas—oil—electric (resistance, 60 cycle induction, arc, or high frequency) . . . we can intelligently and objectively recommend the proper type of furnace to suit your particular conditions and needs.

We can fit the latest melting and holding equipment into your production line efficiently and economically—helping you to manufacture your product to closer specifications, and at a lower cost. Consult your local Lindberg representative. You'll find him listed in the local classified telephone directories in major industrial areas.

Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard Street, Chicago 12, Illinois. Los Angeles plant, 11937 South Regentview Ave., at Downey, Calif. In Canada, EFCO-Lindberg, Ltd., Toronto.
Also factories in: Argentina, Australia, England, France, Germany, Italy, Japan, Scotland, South Africa, Spain and Switzerland.

On the following two pages we've illustrated and described the Lindberg-Fisher equipment that covers all your "heat for aluminum" needs. Will you please turn the page?

Look in on Lindberg—Booth 520 at THE METAL SHOW

LINDBERG heat for industry

FROM THE VERY BEGINNING

Starting with alloyed ingot or molten metal delivery from the reduction cells, aluminum can be processed in a wide selection of furnaces.

In Melting and Holding Furnaces

As shown in the flow diagram molten aluminum is delivered to either large capacity fuel fired reverberatory furnaces, or tilting two chamber induction furnaces for storage at suitable temperature . . . or alloyed ingot is melted and stored in similar furnaces . . . to provide an adequate supply of molten aluminum for the casting station area furnaces.

In Casting Station Furnaces

Molten metal received from the large storage or breakdown furnace described above or from smaller melting furnaces—again either fuel fired or electric, is received at the casting area, maintained at the correct temperature and processed into desired castings. Most of the holding furnaces illustrated can also be used for melting.

Many of the casting station furnaces shown can be equipped with the Lindberg-Fisher Autoladle for automatic ladling or hand ladling.

Hot Metal Delivery

Ingot

Fuel fired reverberatory, melting or holding. Charging well optional.

60 cycle two chamber induction, tilting; melting or holding.

Fuel fired, double reverberatory melting and holding. Especially suitable for alloying. Charging well optional.

60 cycle, two chamber induction, tilting; melting and holding.

60 cycle induction coreless, tilting, especially for melting chips.

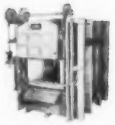
Fuel fired, crucible or pot, tilting, melting.

Electric resistance, "radiant muffle," Dry-Hearth, melting and holding, nitrogen atmosphere, especially for insert scrap.

High frequency induction, tilting, melting.

Autoladle for automatic ladling, four standard sizes available, up to 100 lbs.

HYNI generator, low cost, high purity dry nitrogen.

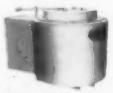


Fuel fired reverberatory, holding or melting.

Electric resistance, "radiant dome," reverberatory, holding.

60 cycle, two chamber induction, holding or melting, stationary.

Fuel fired crucible or pot, holding or melting, stationary.



Electric resistance, crucible or pot, holding or melting, stationary.

Fuel fired, Dry-Hearth, two chamber, holding and melting.

WHEREVER ALUMINUM NEEDS HEAT, LINDBERG—

A unique innovation is the Lindberg HYNI Generator... which supplies dry, high purity nitrogen economically, as a protective atmosphere for both melting and holding applications.

In Remelting Furnaces

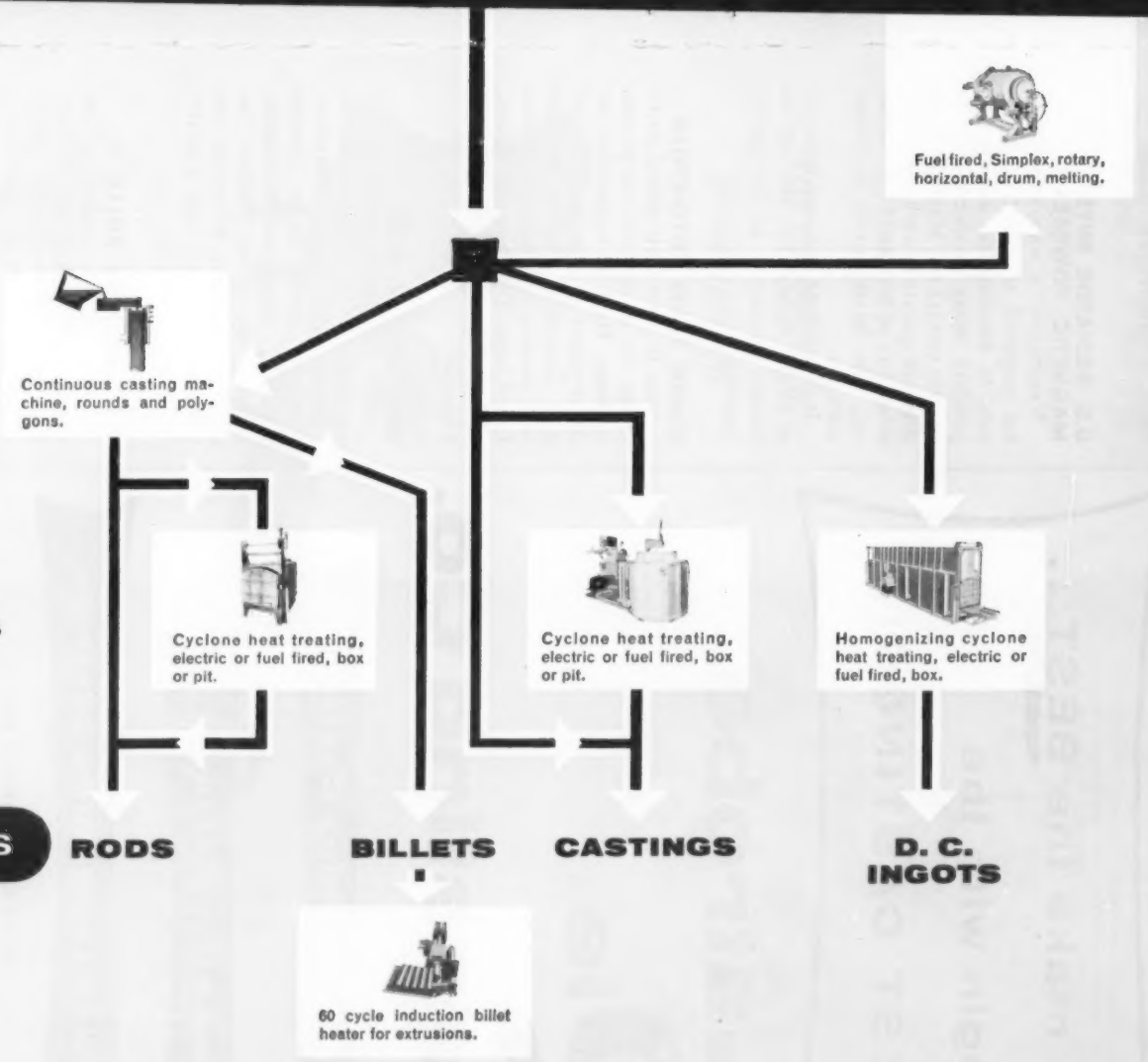
As the castings move out of the casting area for trimming, machining and finishing, the gates, risers, sprues, chips and scrap castings, etc., are returned to a remelt operation in one of the furnaces shown on the far right. These furnaces can be used for ingot meltings as well as for remelt operation.

In Heat Treating Furnaces

From the trimming and sorting station some castings are ready for direct use, others require suitable heat treatment as shown.

TO THE FINAL PRODUCTS

Lindberg can provide ANY furnace for your needs.


Fuel fired, Simplex, rotary, horizontal, drum, melting.
Continuous casting machine, rounds and polygons.
Cyclone heat treating, electric or fuel fired, box or pit.
Cyclone heat treating, electric or fuel fired, box or pit.
Homogenizing cyclone heat treating, electric or fuel fired, box.
RODS
BILLETS
CASTINGS
D. C. INGOTS
60 cycle induction billet heater for extrusions.

FISHER EQUIPMENT WILL APPLY IT MOST EFFICIENTLY

Circle No. 52 on Reader Service Card

LINDBERG heat for industry

To make the BEST...
Begin with the
BEST CASTINGS!

Latrobe
Die
Casting Co.

Aluminum Alloy Castings

Zinc Alloy Castings

Tin and Lead Alloy Castings

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Casting Co.
Latrobe, Pennsylvania

Established 1918

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U.S. RADIATOR BUYS MAGNETIC POWDERS

NATIONAL-U. S. RADIATOR CORP. has acquired MAGNETIC POWDERS, INC., to broaden the line of iron powders being produced by its PLASTIC METALS DIV. Magnetic Powders will operate as a wholly-owned subsidiary of National-U. S. Radiator, with headquarters in Johnstown, Pa.

B. T. duPont, general manager of Plastic Metals Div., also will be general manager of Magnetic Powders.

STROM JOINS ROTO-FINISH

John R. Strom has joined ROTO-FINISH CO. as chemist and process engineer. He'll be responsible for development of new products and new compounds. Strom formerly was process engineer for Brown-Lipe-Chapin Div., General Motors, and plating superintendent for the Eljer Co.

NEW MPI MEMBERS

Here are new members of various trade divisions of the METAL POWDER INDUSTRIES FERERATION: NATIONAL CARBIDE DIE CO., Powder Metallurgy Equipment Association; GLIDDEN CO., Metal Powder Producers Association; NATIONAL CASH REGISTER CO., American Powder Metallurgy Institute.

DEK ACQUIRES ROLLE

ROLLE MFG. CO., producer of aluminum and magnesium castings, has been acquired as a wholly-owned subsidiary by DEK INDUSTRIES, INC. DEK, manufacturer of aluminum products, purchased Rolle facilities as part of a program for diversification and growth in the light metals industry.

R. Carter Dye has been elected president of Rolle, succeeding Zachary W. Redd, and Fred H. Edgar has been elected executive vice president. Both were executives of The Olin Mathieson Chemical Corp. Edgar also is executive vice president of DEK.

William E. Nolan, with ALCOA for 14 years, has been elected Rolle vice president and general manager; Douglas D. Lawson, with General Electric 18 years, becomes vice president in charge of sales.

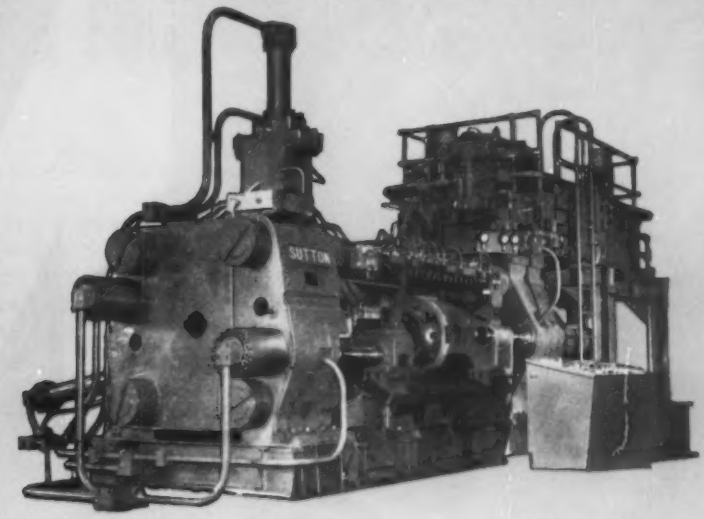
SUTTON

presses and processing machines

for profitable production!

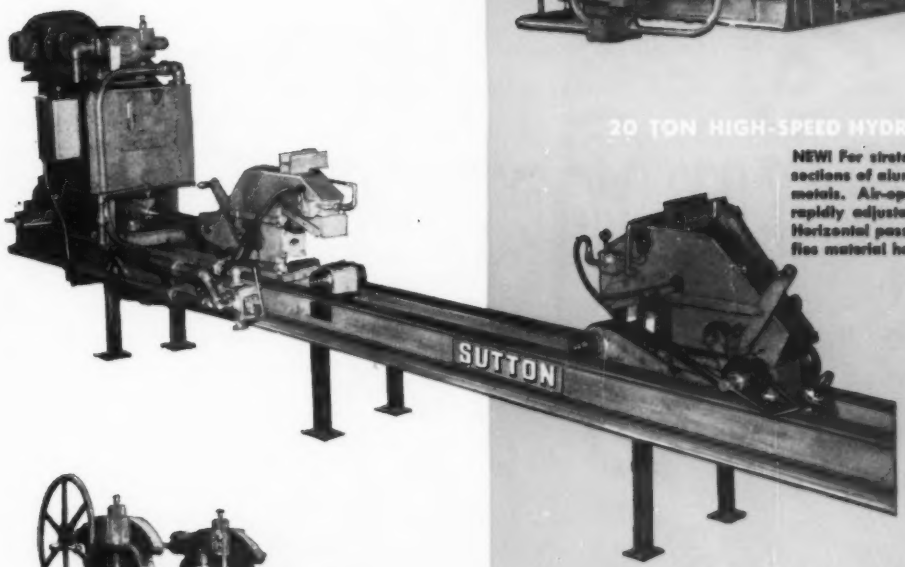
1500/1800 TON ALUMINUM EXTRUSION PRESS

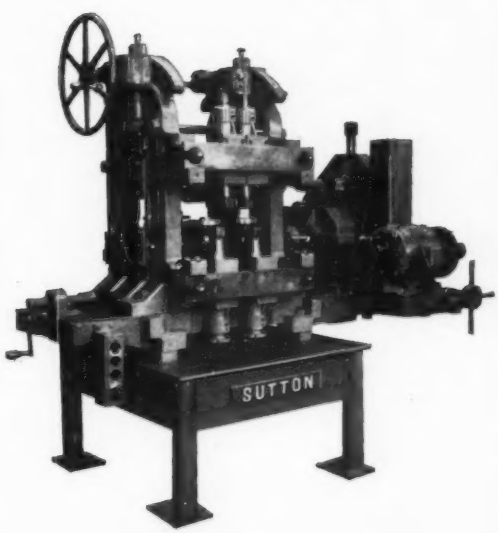
NEW! For high-speed production of aluminum shapes. Featured is a special electric-hydraulic system for entirely automatic cycling with solid, porthole or bridge-type dies.



20 TON HIGH-SPEED HYDRAULIC STRETCHER

NEW! For stretch-straightening extruded sections of aluminum and other modern metals. Air-operated jaws. Tail stock rapidly adjustable for different lengths. Horizontal pass line speeds and simplifies material handling.





PATENTED CONTOUR CORRECTING MACHINE

NEW! Corrects cross-sectional distortions of aluminum extrusions to extremely close tolerances. Multiple corrections can be made in one pass. Easy change-over for different shapes.

Producers and extruders of modern metals are urged to investigate Sutton processing machines as well as presses. For maximum profit, high-speed production must extend beyond extruding or rolling into the various finishing and processing functions.

Sutton engineered processing machines include a full line of hydraulic extrusion presses, bar, tube and shape straighteners, roller levellers, sheet stretchers, detwisters, rotary swagers, centerless bar turners, continuous drawing, straightening and cut-off machines and other important equipment. Each Sutton machine is designed for maximum production per operating hour and is backed by more than 45 years' experience in quality machinery manufacture.

Ask for Bulletins 25 and 50 with supplemental data

SUTTON

Engineering Company

FIRST NATIONAL BANK BLDG., PITTSBURGH 22, PENNSYLVANIA

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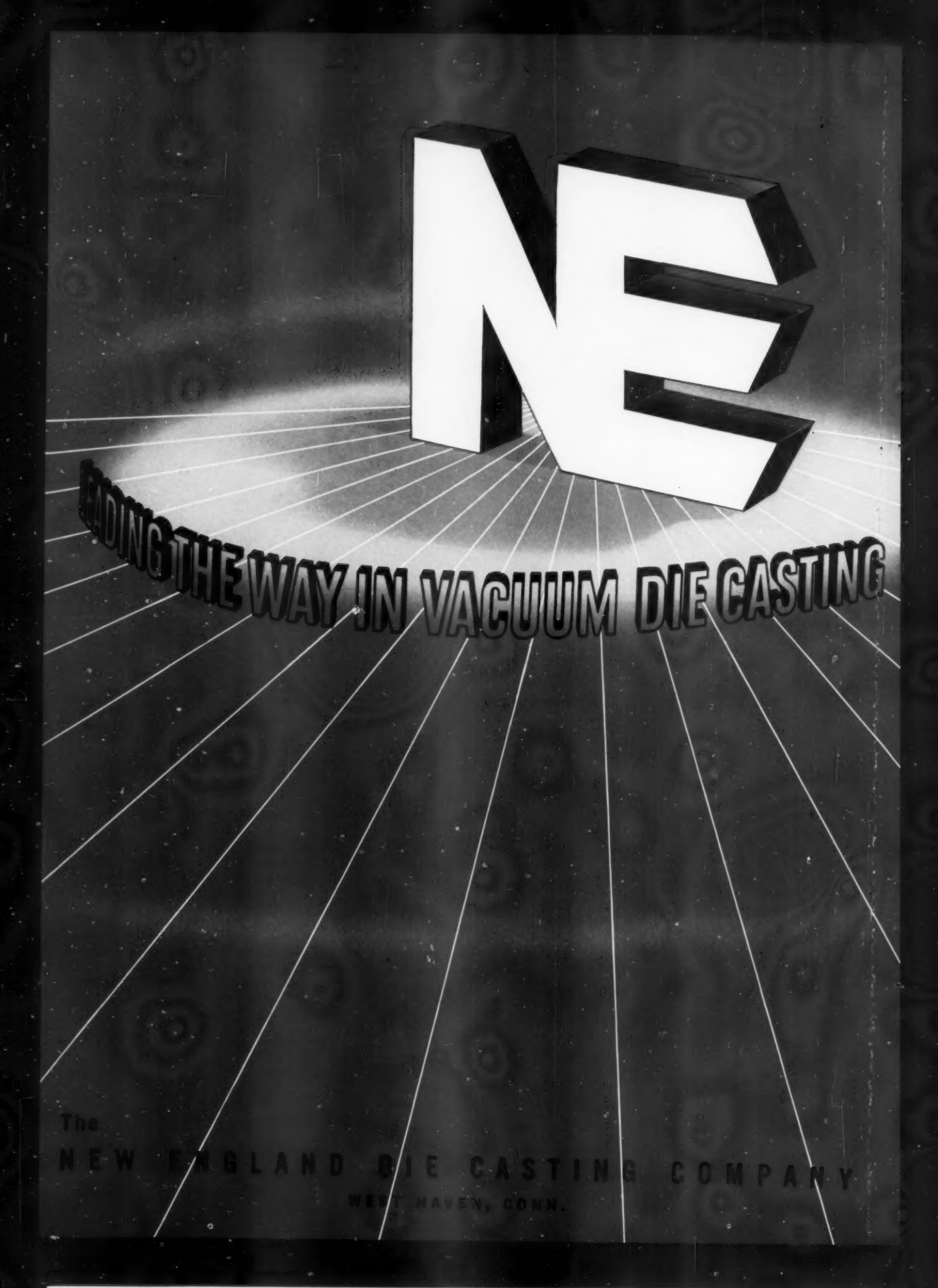

NE
LEADING THE WAY IN VACUUM DIE CASTING
The
NEW ENGLAND DIE CASTING COMPANY
WEST HAVEN, CONN.

Three Steps to a Finished Product

THIS MAY or may not be the year when the round of wage increases set off by increased wages in the steel industry and consequent increases in the price of steel will be halted. It will be some relief to all industries if there is no increase in the price of steel, but don't assume that either your company or your industry will be immune. For the immediate future, wages will continue to increase and, what may even be harder to take, all industry is going to use more and more highly-skilled labor; even the floor sweeper will become an "operating engineer."

Where does this lead us? Simply that original design and redesign must be done in terms of operations which require little direct labor and which can be automated to a high degree. High capital investment in machines and buildings can better be tolerated than high labor costs. High tooling costs can easily pay for themselves. But neither of these may be necessary if designers will take full advantage of the extrusion industry's know-how and ability.

There is probably no metal forming method which can produce a finished shape as economically as extrusion. It takes just three steps from raw material to finished product: Extrude, cut to length, minor finishing. This even includes rolling, provided flat sheets and some standard sections are not considered. After all, sheet, strip, rod, and bar are actually raw material for the start of fabrication.

Now how about tooling? If a lot of direct labor will be saved, quite expensive tooling can be absorbed and still permit a cut in manufacturing costs. But here's one of the great advantages of the extrusion process: Most extrusion dies are cheap. In fact, tooling for the process is so low, compared with other fabricating methods, that most extrusion dies are designed and paid for by the custom extruder, not by the purchaser. For solid sections which can be pushed from a 4- or 6-inch billet, die costs are frequently under $125. So here's another cost item where extrusion is far ahead.

But the designer or purchasing man says he uses only a few pounds of metal at a time. That's another advantage of custom extrusion. Most extruders are set up to push any amount of metal the customer wants, from 25 or 50 pounds per order up. There's some advantage to long runs, of course, but downtime for tool change is very low. This is particularly true when pushing extrusions from 4- to 6-inch billets. Some extruders quote tool change time in seconds.

Now the designer may ask what metals can be extruded. Very broadly, almost any metal which can be rolled can be extruded. Naturally, the available press capacity for extruding aluminum base alloys and copper base alloys is far greater than any other. There exists, however, a very adequate capacity for extruding alloys of magnesium, steel, and the so-called exotic metals.

Cutting manufacturing costs is, therefore, almost entirely a problem for the design, purchasing, and production men. The means to do it, the plant capacity, and the knowledge are all available. Why not use them?

P. R. Kalischer

EDITOR

TABLE I

Shipments of Hot Work Die Steels (net tons)

1949	5,140
1950	8,608
1951	12,995
1952	12,719
1953	14,229
1954	8,857
1955	12,062
1956	14,445
1957	11,924
1958	8,904
1959	8,657*

*Through July 1959 only.

TABLE II

End Uses of Hot Work Die Steel Blanks

Company	Percent of Die Steel Shipped for: Die Casting & Extrusion Dies	Forging Dies
A	70	30
B	65	30
C	90	10
D	90	10
E	85	15
F	84	16
Average	80.67	19.33

TABLE III

Aluminum Consumed for Extrusions

Year	Tons of Aluminum Extruded	FRB Index (= 100)
1950	255,079	——
1951	312,944	——
1952	347,542	136
1953	462,400	153
1954	449,632	137
1955	682,381	155
1956	704,535	159
1957	706,587	160
1958	743,123	142
1959*	——	159

*estimated

Rising die steel sales foretell . . .

Greater Industrial Use of Extrusions

WITHOUT hot work die steels, there probably would be no extrusion industry. Sales of these steels should, therefore, be a valuable guide to the growth of the industry.

While sales of metal to be extruded might be used to measure growth, it is possible to get a biased picture from metal sales alone. For example, a boom in building could show a surge in the amount of aluminum extruded, due to the present widespread use of extruded shapes for windows, doors, and other architectural shapes.

When, however, extruded shapes find their way into a wide variety of products, the need for increasing tonnages of hot work die steel is assured. Under these conditions, the industrial growth is healthy and a business slowdown in any single application cannot dislocate the entire extrusion industry.

There are only three major uses for hot work die steels. These are the extrusion, die casting, and forging industries. Of these, the forging industry uses only about 20% of the die steel sold.

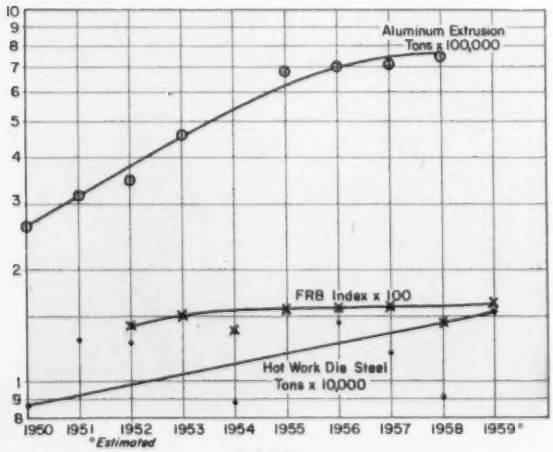


FIGURE 1.

Steel for die casting and extrusion dies, however, can not be separated, since companies who supply forged die blanks specialize to a considerable extent. This is not necessarily bad. Extrusion and die casting are, for the most part, complimentary. There are very few areas where they compete seriously. With this in mind, let's look at some of the available figures for sales of hot work die steels and for extrudable metals.

The sales of hot work die steels (H11, H12, H13, H14, H15, H16, H20, H21, H22, H23, H24, H25, H26, H41, H42, and H43), released by the American Iron & Steel Institute, are shown in Table I.

These shipments are broken down by six major forging companies in Table II.

Over the past ten years, the consumption of aluminum, to take only one metal, for extrusions and the Federal Reserve Board Index of Industrial Activity are shown in Table III.

The data in Tables I and III are shown in Figure 1 to compare the slopes of the curves which give the rate of change. If the industry were not growing, the slope of the curve for consumption of metal would be about parallel to the curve for industrial activity. Since, however, it is considerably steeper, there is evidence of rapid growth. Unfortunately, no figures for steel and copper base alloys are available, but those companies engaged in the extrusion of these metals, particularly copper base alloys, have reported that activity would closely parallel the activity in the extrusion of aluminum.

With the sales of hot work die steel for the first seven months of 1959 almost equal to the entire year of 1958, there is every reason to believe that the steady rate of growth of the extrusion industry will continue.

Cold Extrusion of Steel

By P. G. WITTEMAN*

COLD EXTRUSION of steel – sometimes referred to as cold shaping – embraces methods of producing solid or hollow cylindrical shapes by systems of tooling applied to vertical and horizontal presses, as well as multiple stage headers.

What is now accepted as heavy cold extrusion of steel was disclosed in the years 1946 and 1947, as recorded by reports of the Ordnance Department of the United States Army, in cooperation with the Publications Board of the United States Department of Commerce. The information and data correlated German experience prior to and during World War II. Dire necessity, due to the lack of certain non-ferrous metals, gave considerable impetus to the use of steel in the production of some military components, principally cartridge cases. The feasibility of the entire venture was made possible by the coating, wherein a phosphate coat is applied by a bonderizing treatment.

Implementation of the various processes was started about 1949 by the Ordnance Department of the United States Army in cooperation with American industry, so that today production techniques have been fully realized. Naturally, some of the end products involved were high explosive shell and rocket bodies, ammunition components, and cartridge cases.

The experience with the military firmly established the know-how in cold extrusion of steel, and this has now been extended into industrial and automotive applications involving quantity production.

The versatility of the cold extrusion processes, combined with appropriate heat treatments (process annealing and final stress relieving), permits the use of many steel compositions, a partial list being:

Carbon Steels: C1008, C1010, C1012, C1015, C1016, C1017, C1020, C1021, C1023, C1024, C1025, C1030, C1035, C1040, C1041, C1045, and C1046.

Alloy Steels: 4023, 4130, 5120, 5130, 8620, and 8630.

All steels should be made to fine grain practice. Experience has shown preference for a non-aging type steel, with low silicon in most of the carbon steel grades. The chemical compositions which qualify for cold extrusion provide for a diversification of mechanical properties which can be balanced with the amount of cold deformation for high tensile properties and recovery of useful ductility by a final stress relieve treatment. Indeed, it is possible to develop mechanical strength levels in low carbon steels comparable to steels heat treated by quenching and tempering. Some results are given in Table I.

Compared with conventional methods of forging and machining, the cold extrusion processes save steel. This is also true in the assembly of component parts by welding, soldering or brazing.

For example, a cold shaped hydraulic cylinder required a billet weight of 2.2 pounds cut from C1015 steel bar stock which produced a finished weight of 2 pounds, or a yield of 91 per cent. The conventional method of manufacture by machining and welding component parts required 6 pounds.

The cold extrusion processes are essentially "chipless" and considerable savings can be affected in material losses. Where secondary machining operations are necessary, such as reaming, boring, tapping, threading, and broaching, there is less metal removal because of much closer tolerances. Higher metal cutting rates are normally attained, especially in low carbon steels, due to the effect of cold working.

*ASST. METALLURGICAL ENGINEER BETHLEHEM STEEL CO.

TABLE I

Average Mechanical Properties of Rounds, Forward Extruded*

AISI Grade	Percent Reduction	Stress Relief Degree F	Yield Strength psi 0.2% Set	Tensile Strength psi	Elong. 2" Percent	Reduction Area Percent	Hardness Rb
C1010 Fine Grain	20	No	63975	68075	19.1	64.1	79.5
	40	No	85300	91250	15.6	54.9	88.0
	60	No	96575	101050	15.4	49.5	95.0
	20	900	59400	66600	23.4	65.4	85.0
	40	900	73500	82400	23.2	57.4	90.0
	60	900	87000	93400	21.0	55.3	92.0
C1040 Fine Grain	20	No	97875	110150	14.4	44.9	94.0
	40	No	112550	125750	12.5	41.4	98.5
	20	900	91200	104600	20.3	45.4	96.0
	40	900	108100	113600	20.3	46.1	101.0
5120 Fine Grain	20	No	80150	91900	17.9	67.1	90.0
	40	No	103700	115900	16.4	55.8	98.5
	60	No	120125	129450	16.4	52.5	102.0

*Report of Metallurgical Research on "Cold Extrusion" by Heintz Manufacturing Co., Philadelpsia 20, Penna.

Progress Report from Integrated Extruders

WHEN AN INDUSTRY enjoys a phenomenal growth – such as that experienced by the extrusion industry – it's generally backed up by a good, solid group of progressive producers whose research and development work is passed along to users in the form of improved, lower-cost products.

To give our readers a broader perspective of the extrusion industry, we asked different integrated producers (producers of both metal and extrusions) for brief opinions on significant contributions to the progress of the industry, what its status is today, and what's in store for the future.

SIGNIFICANT TECHNOLOGICAL ADVANCES

ALUMINUM CO. OF AMERICA

The most significant technological advances in the industry in the past 10 years, we believe, have been:

- The installation of large extrusion presses and the resulting new products made available, particularly wide, flat wing panel type sections.
- Development and use of color for outside architectural extruded shapes. This includes dyed anodic coatings, built-in anodic coatings, porcelain enamel finishes, and paint finishes.
- Semi-automatic and/or automatic press operation, including improved press controls.
- Improved die technology.
- Improved production speeds.
- Self-contained presses for limited and/or specialized use.
- Improved ingot heating facilities.
- Improved material handling at presses.
- Higher productive rates.

TRENDS IN STEEL EXTRUSIONS

THE BABCOCK & WILCOX CO., TUBULAR PRODUCTS DIV.

At least at the present time, steel extrusions do not follow the pattern of the non-ferrous extrusion industry in that there are no standard shapes or stock shapes produced in the steel industry. We hope this may occur when we get into carbon steel but, as yet, in the stainless steel picture there has been nothing in the way of standard shapes except those produced specifically for jet aircraft and nothing is standard in the aircraft industry for more than a few weeks at most.

In the stainless extrusion industry, the trend is toward more refractory metals and thinner sections. The trend in industry, as far as production is concerned, is more in the way of reducing manufacturing costs.

We have made great strides in recent months in reducing the size of the extruded shapes which we could successfully produce. It would be safe to say that we have extended the range of availability of steel extrusions both at the top and the bottom of the size ranges; however, as far as any trend toward any specific size, the present market covers the complete range and there is always more interest in the small sections below our size range than in large sections above the range.

GROWTH OF ALUMINUM APPLICATIONS

HARVEY ALUMINUM, INC.

Construction applications will continue to be the largest user of aluminum extrusions. In 1960 we believe that the transportation industry will be the next largest user of extruded shapes. Applications include automotive, aircraft, truck trailers, mobile homes, and we anticipate greatly increased penetration into railroad and marine applications.

The automotive field presents the largest immediate potential for extrusions. The trends in sizes and shapes of extrusions are to larger, more intricate configurations. Stiffened panels are replacing sheet and plate weldments.

The use of structural aluminum is becoming more pronounced, and is replacing other metals. In aluminum alloys, aircraft and missile people are demanding higher strength and more intricate sections. There is also a trend in alloys possessing special control characteristics favorable to decorative finishes.

Because of the low cost of custom extrusion dies, we see a continuous trend away from stock shapes.

MILESTONES IN EXTRUSION'S PROGRESS

KAISER ALUMINUM & CHEMICAL CORP.

Our technical people suggest the following as some of the more significant contributions to the progress of the extrusion industry over the past 10 years:

- The development of self-contained presses and the improvement of extrusion press design.
- The development of bridge and spider type dies for the manufacture of hollow sections.
- The general improvement in die design and die engineering to permit closer tolerances and thinner and more complex shapes.
- The provision of markedly improved extrudability of 6063 billet by improved cleanliness, improved control on chemical analysis, and the introduction of homogenization. (While the introduction of 6063 alloy actually took place in 1945, or 14 years ago, it is probably the most significant single contribution to the extrusion industry since World War II.)
- The availability of smaller DC billet and the resulting elimination of needing book mold type billet.
- The institution of the heavy press program and the resultant availability of larger and more complex aircraft sections.
- The introduction of induction heating of billets.
- The availability of higher strength non-heat treatable alloys through the offering of the aluminum-magnesium and aluminum-magnesium-manganese alloys, such as 5083 and 5086.
- Development of architectural finishing alloys offering improved surfaces for anodizing and selection of color.

WHAT'S THE FUTURE LOOK LIKE?

OLIN MATHIESON CORP., METALS DIV.

There isn't too much need to resort to crystal ball gazing, for the extrusion forecast of the future is bright and stands forth for all to see.

Output will rise significantly this year over last year by at least some 25%. Usage will continue to rise sharply in 1960, so that by 1964-65, the 1958 usage of approximately 800,000,000 pounds will be doubled. The anticipated population explosion of the 60's, with the resultant building and industrial expansion, will assure this.

Other than building and architectural shapes, we think the greatest new usage will be in the electrical field with aluminum rigid conduit capturing a major share of the larger sizes (over 1½") and aluminum in busbar, substation and transmission facilities making substantial inroads in areas heretofore economically denied them. Transportation, including automotive, will design more and more to aluminum extrusions to take advantage of its low weight, high strength features.

The "containerization program" for ship and rail use is rolling, increasing extrusion usage tremendously.

As to alloys, a major trend is now apparent in two areas: the high lustre, brilliant finish of 6463 and allied alloys, and the high mag alloys such as 5083, 5086 and 5456 because of their weldability and good retention of mechanical properties.

In size and shape, extrusions will retain pretty much the same dimensional characteristics, with some 80% to 90% of shapes producible on current press equipment. There is a definite trend, however, away from stock shapes, especially in architectural uses. Designers and architects have learned well the versatility inherent in extruded shapes, and their products are being designed on a custom basis to lend the dignity of unique appearance to much of their work.

MORE INDUSTRIES USING EXTRUSIONS

REYNOLDS METALS CO.

At present, we estimate that more than half the extrusion and tube shipments are used in architectural and building products, with windows taking the bulk of the output. Significant quantities are also used in many other fields. Aircraft, trailers, cars, furniture, appliances, and irrigation pipe are among the most important of the current applications.

The electrical field has recently been invaded with competitively-priced aluminum rigid conduit. New designs in electrical sub-station structures and transmission towers have opened a large potential for extrusions, and the use of interlocking shapes make transformer enclosures a likely prospect for the immediate future.

Other significant areas offering good opportunities include bridges, pipe for the petroleum and process industries, freight cars, highway sign interlocking panels and ground supports, and monumental buildings. Underlying the trend toward diversification of applications in the use of heavier shapes.

Basically, the flexibility of design afforded by the extrusion process permits the mill to supply aluminum products which minimize further fabrication and assembly time, lowering further costly labor expenditures. This feature, together with the growing favorable cost of basic aluminum, indicates that much of the future of the aluminum extrusion process has yet to be unfolded.

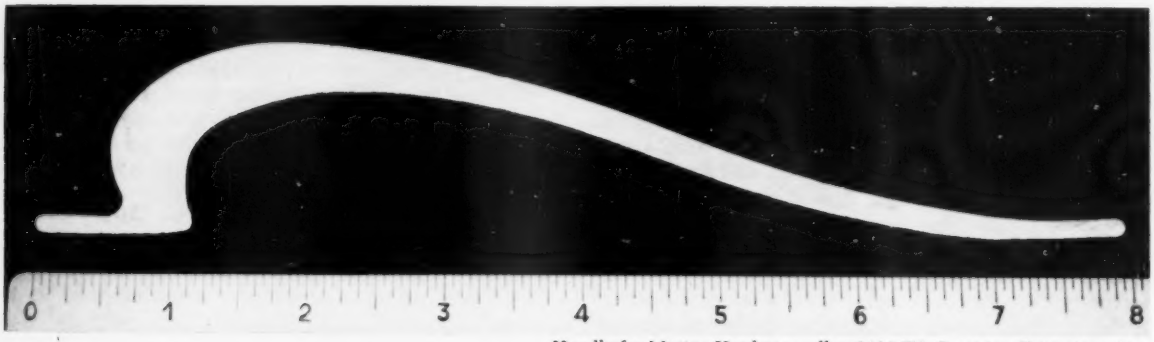
What Shapes Can Be Extruded?

TO ILLUSTRATE the great variety of shapes and sizes which can be extruded, we asked extruders to send us representative samples of work they are currently producing.

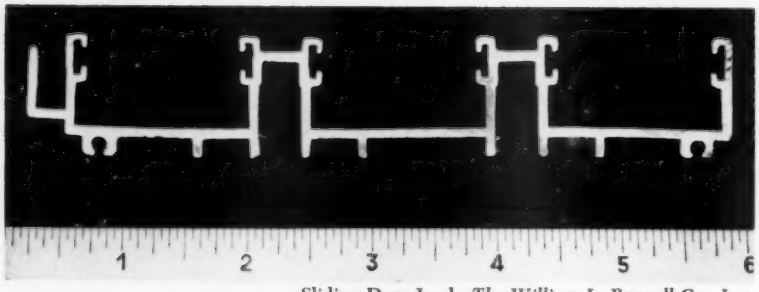
Naturally, not every shape that has ever been extruded is shown here, since it would be impossible to show them all. However, these typical shapes do indicate the vast potential of the industry. There is enough of a variety illustrated here to give most design engineers a good idea of what can be done by the extrusion process.

The examples have been broken down into these general types: Solid Aluminum Extrusions, Hollow Aluminum Extrusions, Aluminum Impact Extrusions, Extruded Brass Shapes, Extruded Steel Shapes, and Extruded Nickel-Silver Shapes.

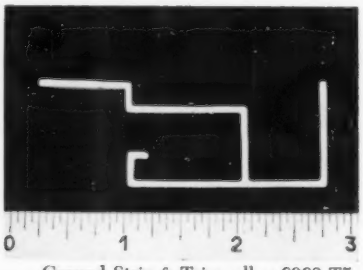
SOLID ALUMINUM EXTRUSIONS



Handle for Marine Hardware, alloy 6463-T6, *Precision Extrusions, Inc.*

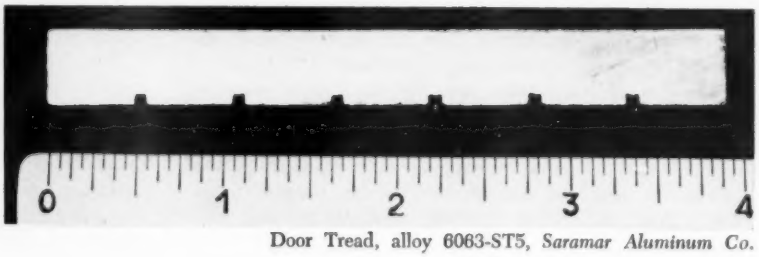


Sliding Door Jamb, *The William L. Bonnell Co., Inc.*

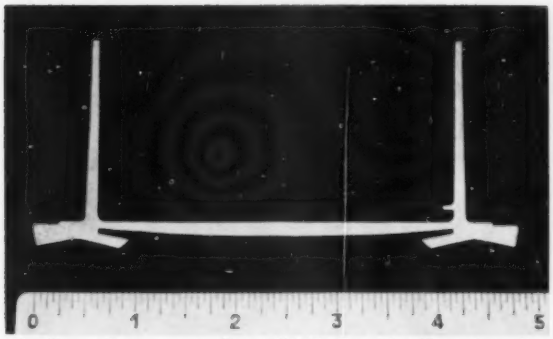


Ground Strip & Trim, alloy 6063-T5, *Superior Industries, Inc.*

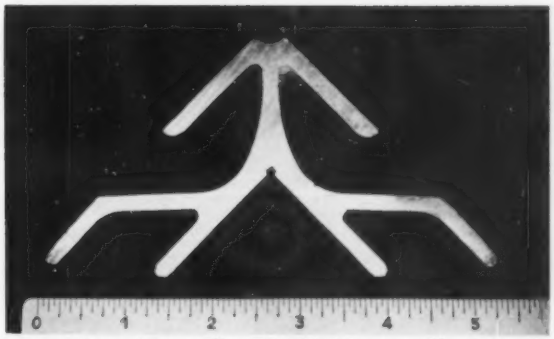
Marine Molding, alloy 6063-T5, *Youngstown Mfg. Co.*



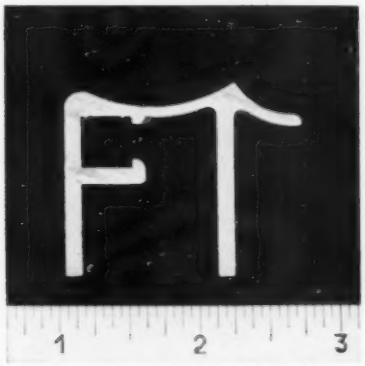
Door Tread, alloy 6063-ST5, *Saramar Aluminum Co.*



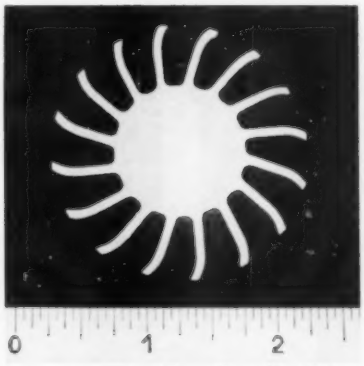
Appliance Component, alloy 6463-T6, *Precision Extrusions, Inc.*



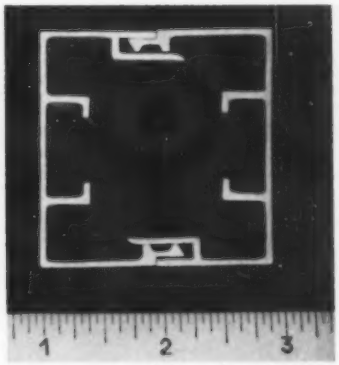
Door Corner, alloy 6063-ST5, *Saramar Aluminum Co.*



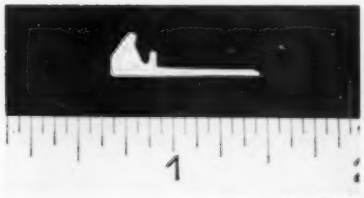
Door Section, alloy 6063-T5
Youngstown Mfg. Co.



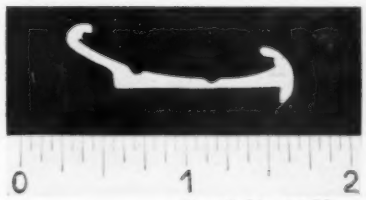
Water Pump Propeller Unit,
Valley Metal Products Co.



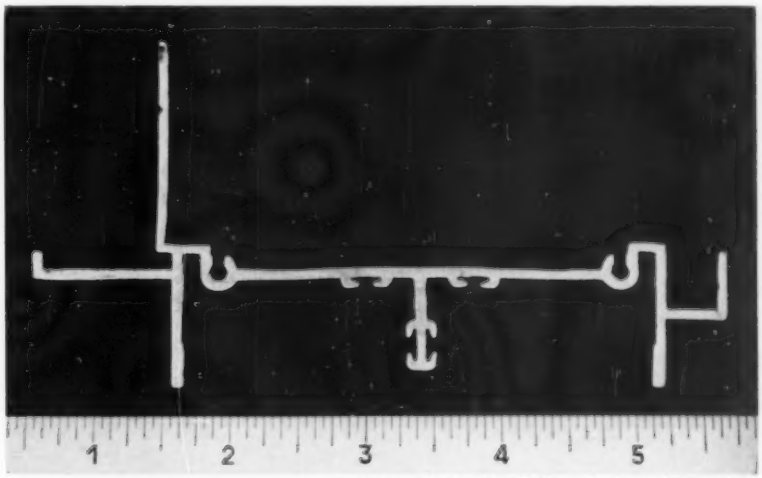
Structural Box, alloy 6063-T5,
Youngstown Mfg. Co.



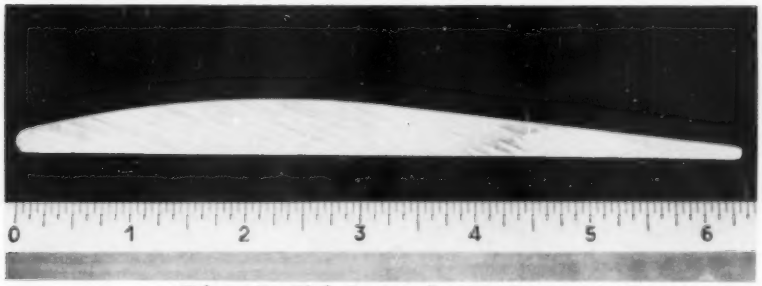
Typewriter Part,
General Extrusions, Inc.



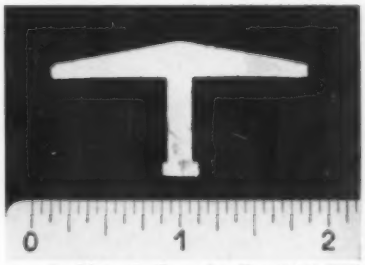
Tag-Holder Molding,
General Extrusions, Inc.



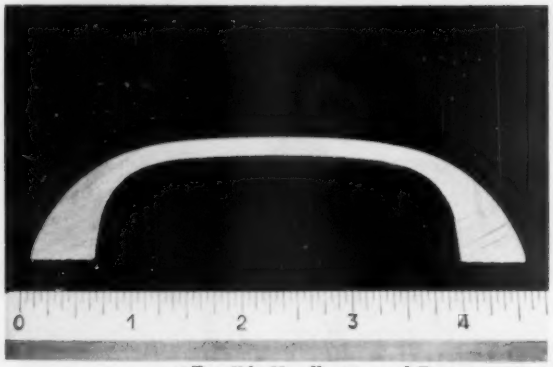
Fin Trim Jamb, *The William L. Bonnell Co., Inc.*



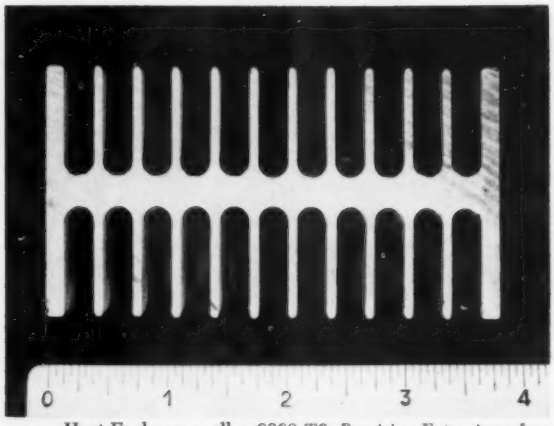
Exhaust Fan Blade Section, alloy 6463-T6, *Precision Extrusions, Inc.*



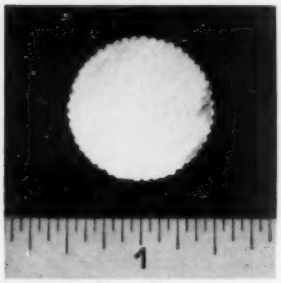
Building Grillework, alloy 6063-ST5
Saramar Aluminum Co.



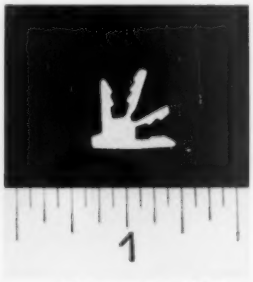
Office File Handle, *General Extrusions, Inc.*



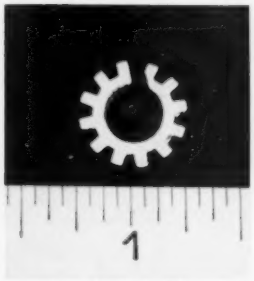
Heat Exchanger, alloy 6063-T6, *Precision Extrusions, Inc.*



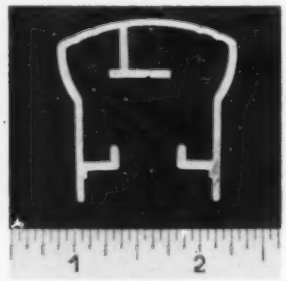
Decorative Post, alloy 6063-ST5, *Saramar Aluminum Co.*



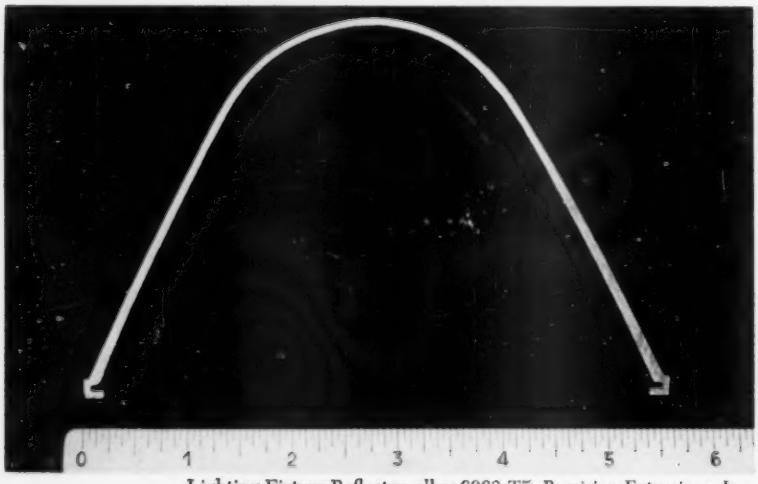
Camera Case Edging, *General Extrusions, Inc.*



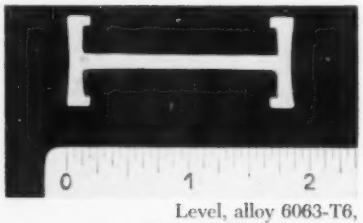
Radio Heat Disperser, *General Extrusions, Inc.*



Handrail, alloy 6063-T5, *Youngstown Mfg. Co.*

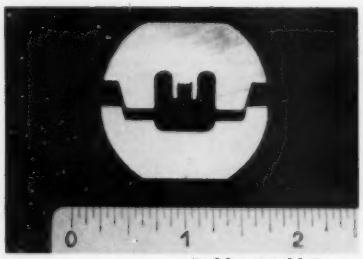


Lighting Fixture Reflector, alloy 6063-T5, *Precision Extrusions, Inc.*

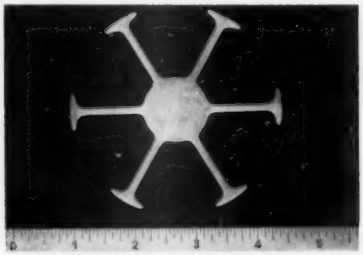


Level, alloy 6063-T6, *Precision Extrusions, Inc.*

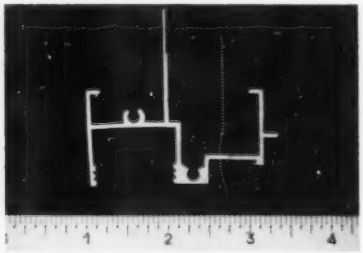
Awning Component, *General Extrusions, Inc.*



Rubber Mold Parts, *R. D. Werner Co., Inc.*

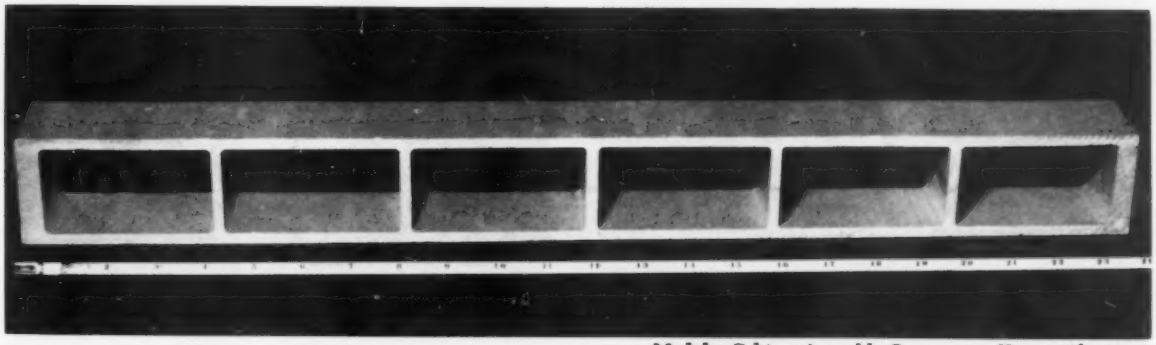


Military Fin Section, alloy 6061-T6, *Youngstown Mfg. Co.*

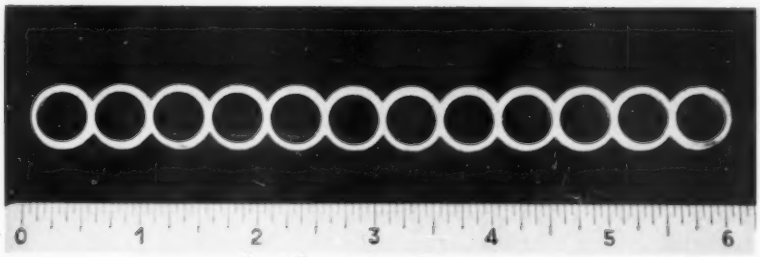


Frame Jamb, *The William L. Bonnell Co., Inc.*

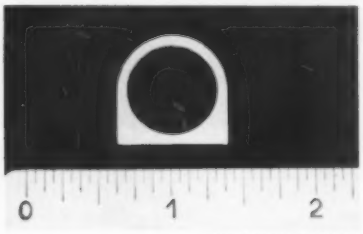
HOLLOW ALUMINUM EXTRUSIONS



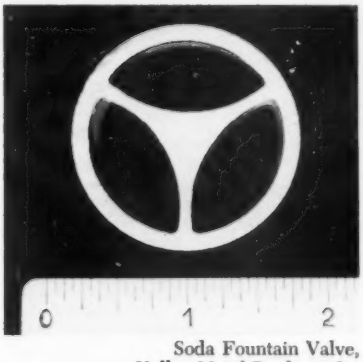
Modular Cabinet Assembly Component, *Harvey Aluminum*



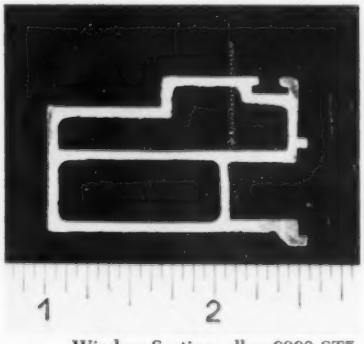
The William L. Bonnell Co., Inc. (Application Not Disclosed)



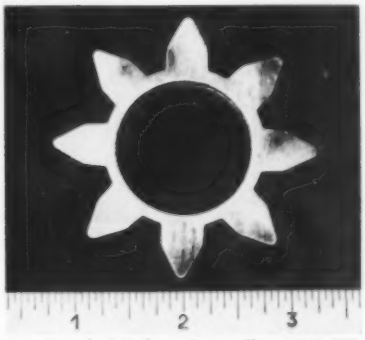
Automotive Part.
General Extrusions, Inc.



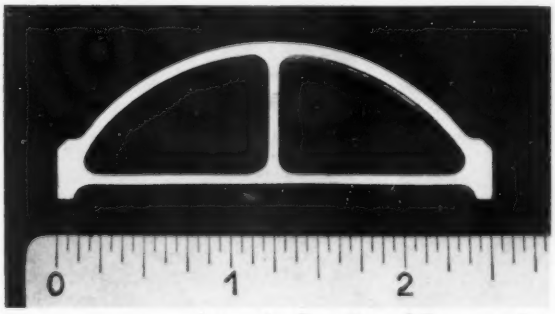
Soda Fountain Valve,
Valley Metal Products Co.



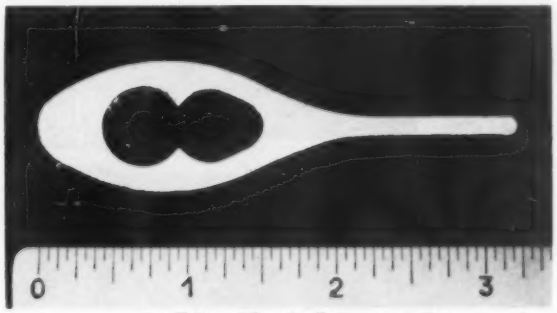
Window Section, alloy 6063-ST5,
Saramar Aluminum Co.



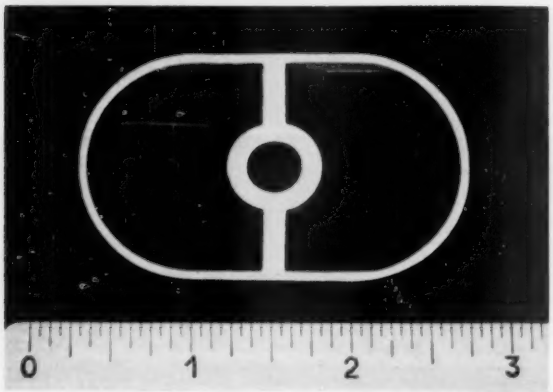
Textile Machine Part, alloy 6063-T5,
Superior Industries, Inc.



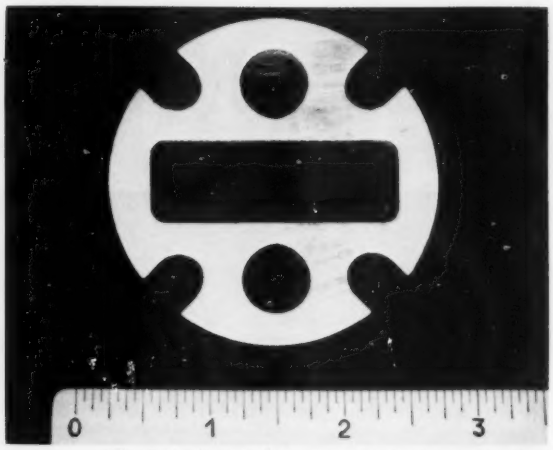
Automotive Part, *General Extrusions, Inc.*



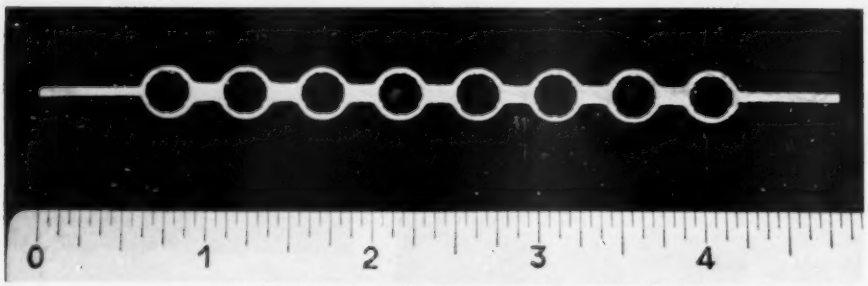
Small-Boat Flag Staff, *Precision Extrusions, Inc.*



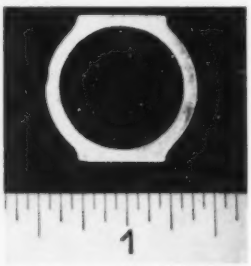
Office Furniture Desk Leg, *General Extrusions, Inc.*



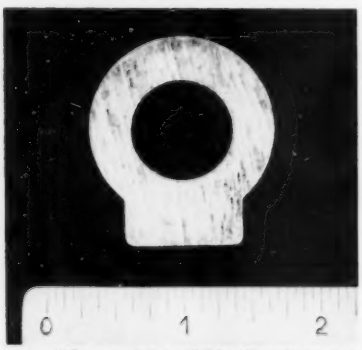
Blood-Typing Machine Part, *R. D. Werner Co., Inc.*



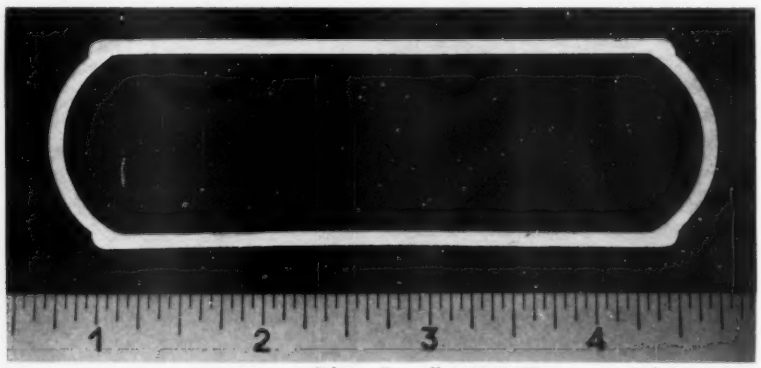
Nuclear Energy Application, special alloy M-388, *Precision Extrusions, Inc.*



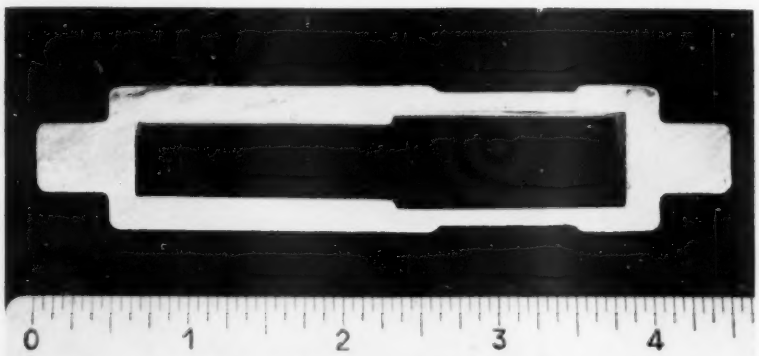
Sprinkler Part,
R. D. Werner Co., Inc.



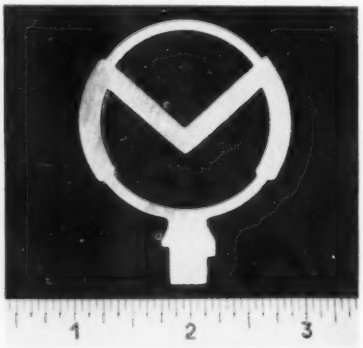
Electrical Manifold, alloy 6061-T6,
Precision Extrusions, Inc.



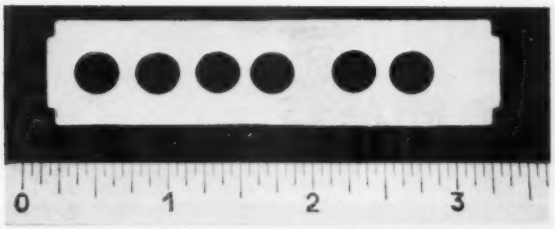
Pilister Bar, alloy 6063-T5, *Superior Industries, Inc.*



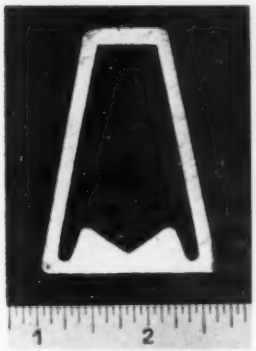
Commercial Lock Barrel, alloy 6062-T6, *Precision Extrusions, Inc.*



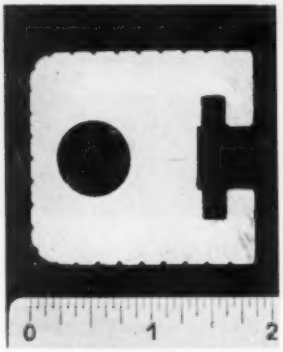
Automotive Part,
General Extrusions, Inc.



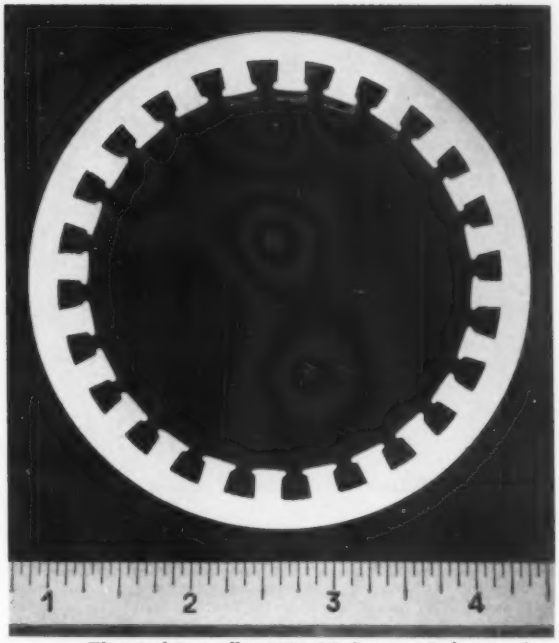
Radiator By-Pass Tube, *General Extrusions, Inc.*



Handrail, alloy 6063-ST5, *Saramar Aluminum Co.*

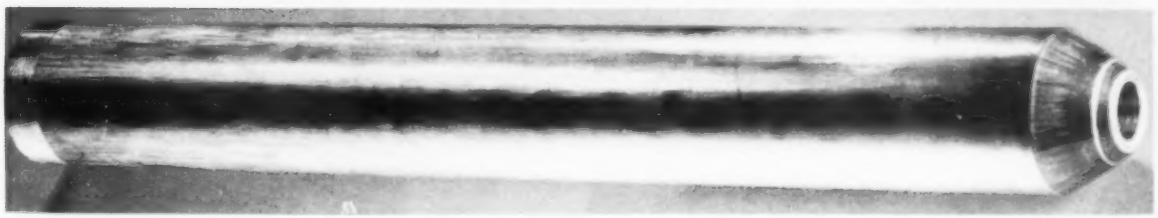


Freezer Part, alloy 6063-T6, *Precision Extrusions, Inc.*



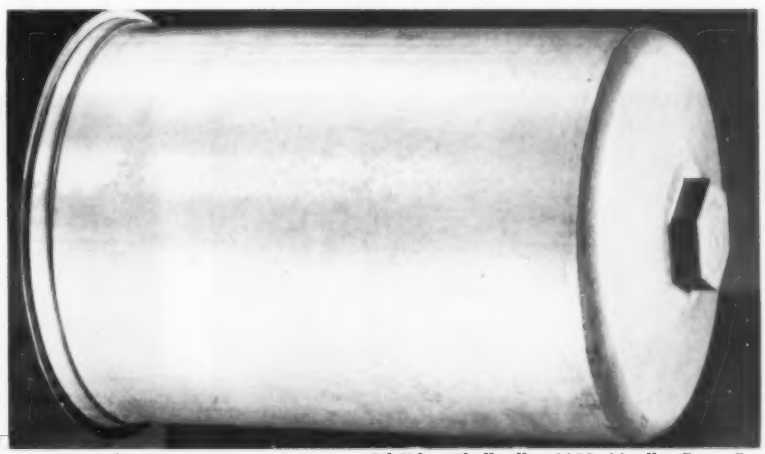
Electrical Part, alloy 6063-T5, *Superior Industries, Inc.*

ALUMINUM IMPACT EXTRUSIONS



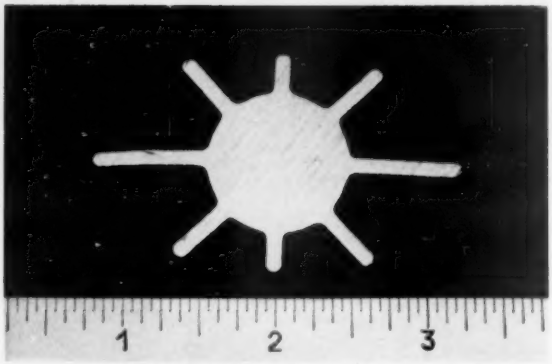
Door Closer Cylinder, alloy 3003, *Mueller Brass Co.*

Electrical Connector, alloy 1100, *Mueller Brass Co.*

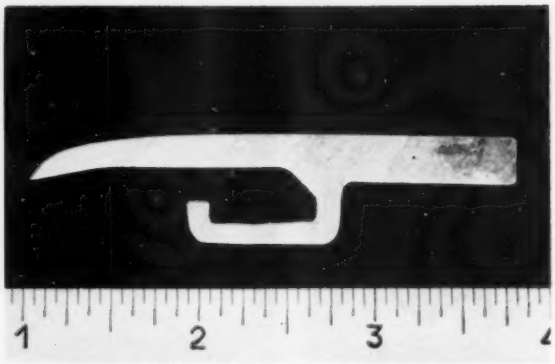


Oil Filter Shell, alloy 1100, *Mueller Brass Co.*

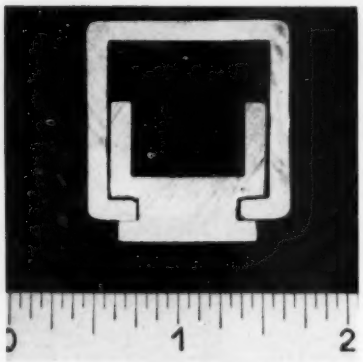
EXTRUDED BRASS SHAPES



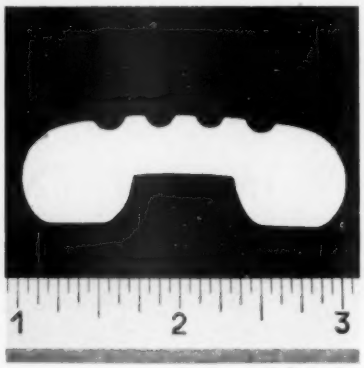
Heat Dispersal Unit Part, *The American Brass Co.*



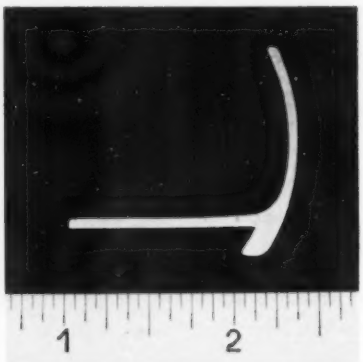
Paper Machine Blade Holder, *The American Brass Co.*



Door Track & Glider, *The American Brass Co.*

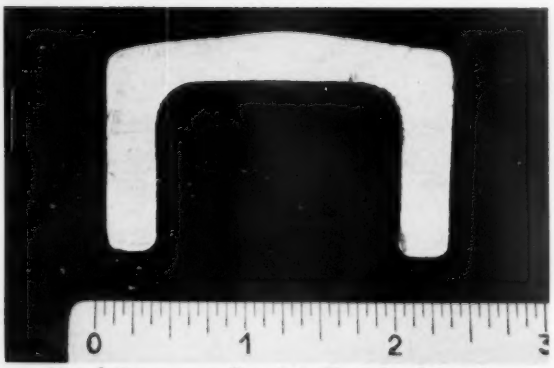


Conveyor Belt Links, *The American Brass Co.*

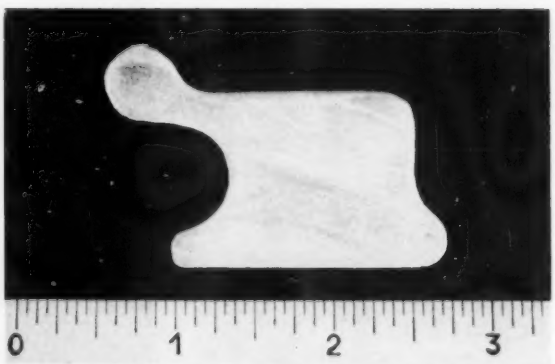


Stair Tread Nosing, *The American Brass Co.*

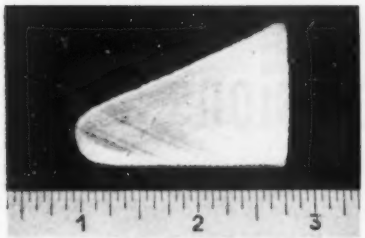
EXTRUDED STEEL SHAPES



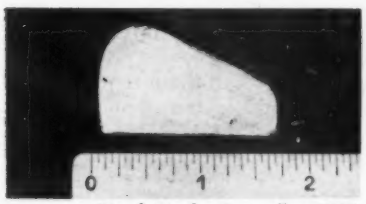
Aircraft Component, alloy 4340, *The Babcock & Wilcox Co.*



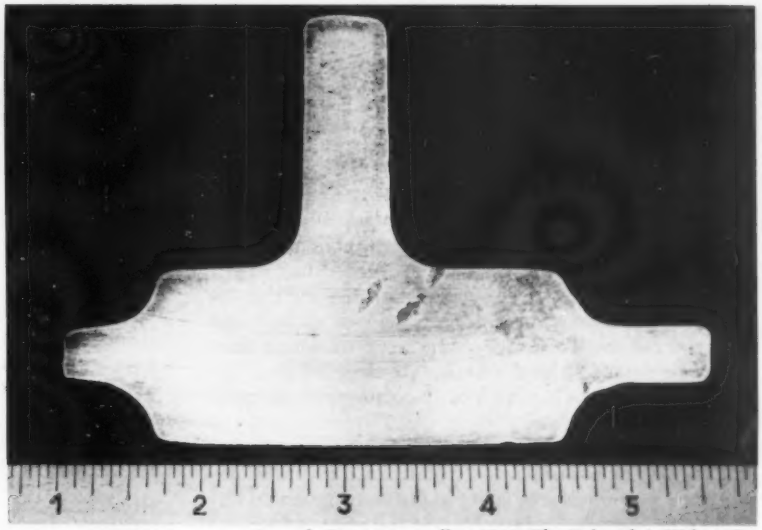
Machine Part, alloy 4340, *The Babcock & Wilcox Co.*



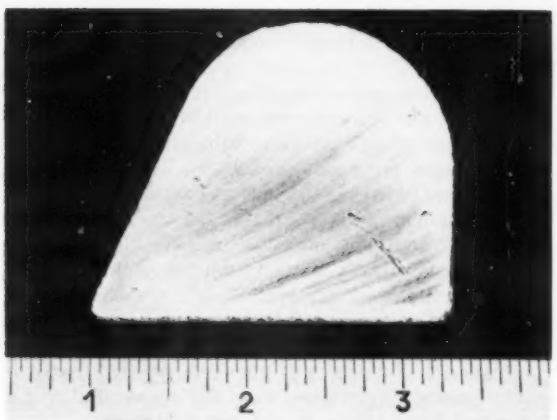
Cold Drawn Bar, alloy 1015, *The Babcock & Wilcox Co.*



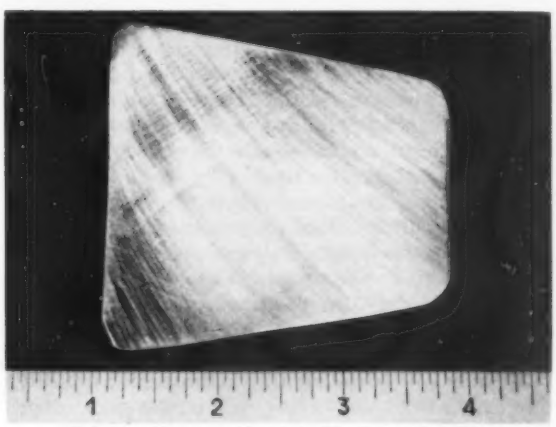
Truck Trailer Part, alloy 1025, *The Babcock & Wilcox Co.*



Aircraft Component, alloy 4340, *The Babcock & Wilcox Co.*

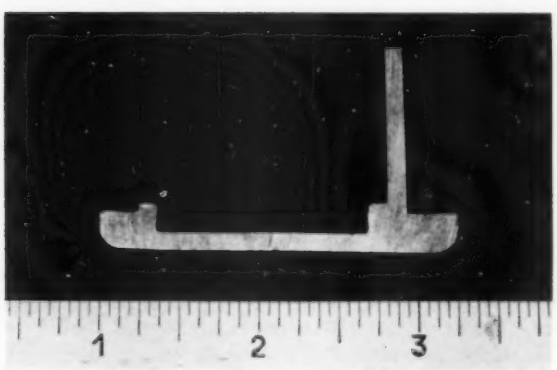


Cold Drawn Bar, alloy 1015, *The Babcock & Wilcox Co.*

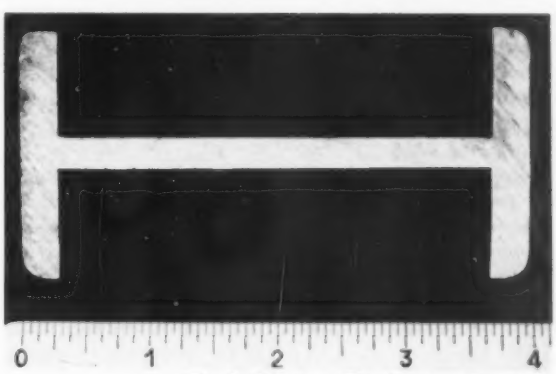


Valve Application, alloy 321, *The Babcock & Wilcox Co.*

EXTRUDED NICKEL-SILVER SHAPES



Stair Tread Nosing, *The American Brass Co.*



Handrail Section, *The American Brass Co.*

How Lightolier Buys Extrusions

By G. W. FUCHS*

THE LAMPS and lighting fixtures merchandised by Lightolier must fill three basic prerequisites. They must (1) give the proper type of lighting for the application, (2) be styled in such a manner as to blend with the decorative motif of the area in which they are to be installed, and (3) be constructed and finished with materials which will retain their original appeal for many years.

Most of the Lightolier line is in contemporary styles, and the use of aluminum extrusions enables us to obtain the crisp lines and sharp corners so much in demand by today's architects and interior designers. It also makes it possible to combine the required mechanical features with the decorative accents, often enabling us to substitute one integral part for an assembly of several parts. The process virtually eliminates the corner radii which are a necessary evil in most sheet metal fabrication. Furthermore, the popular brushed metallic finishes are much more durable when anodized on aluminum than their electrodeposited counterparts on steel.

An additional important aspect of using extrusions is the relatively low tool cost, making it possible for Lightolier to incorporate style and mechanical changes with ease. We have found extrusions particularly suitable when used as the frame for plastic or glass diffusers on recessed fluorescent lighting installations. In fact, the extruded frame surrounding the diffuser is the only part of the lighting fixture which protrudes downward from the ceiling and is therefore subject to the most critical scrutiny by the designer. We have also had good success in using extrusions as floor and table lamp stanchions.

Generally speaking, all aluminum extrusions purchased by Lightolier are of 6063T5 alloy, which anodizes well and is readily obtainable throughout the country. All shapes have some secondary fabrication and finishing requirements. Of all these requirements, only sprayed enamelled finishes are applied in our own factory, and the rest of these requirements are met by our vendors.

*PURCHASING DEPT. CORONA CORP.

HOW VENDORS ARE SELECTED

Selection of vendors is based on their ability to do the job, to meet quality standards, to deliver on schedule, and to be priced competitively. Other than these, we have no formal vendor qualification standards.

Requests for quotation always go to at least three, usually six, known, and one unknown source with no particular emphasis on geographical location. Prices are compared on a delivered basis. The inclusion of an unknown source enables us to continually improve our vendor list.

We have found it easiest to work with the larger independents, ideally those who have their own fabricating and finishing facilities. We also have satisfactory arrangements with extruders who subcontract most of the secondary work. Inasmuch as secondary fabrication and finishing is involved, we feel that it is of the utmost importance that the responsibility for doing the entire job rests with one company.

The integrated companies can, of course, offer all

EDITOR'S NOTE: The question has often been asked, "What is the value of a purchasing department? Is it simply the office boy for engineering and management or does it fulfill a needed function?"

The answer varies, of course, in different companies. There are some where top management and engineering are so jealous of their prerogatives that the purchasing department has only the privilege of mailing out bid invitations to preselected vendors, transmitting the bids to management, and finally writing up the forms and purchase orders for the successful bidder.

Fortunately, such companies are the exceptions. In properly organized and operated companies, the purchasing department has clearly defined jobs and responsibilities. Their job is to see that material which meets specifications is delivered to the manufacturing sections at the right time in the right amounts so there is an orderly flow of work through the plant. They have to screen potential vendors to assure financial responsibility to fulfill contracts. In many cases, purchasing must examine management-labor relations to make sure that under normal conditions there will be no stoppage of material due to strikes. And above all, a good purchasing department makes certain that both purchaser and vendor are talking the same language so that unusable material will not be delivered due to incomplete specifications or poorly defined or interpreted conditions.

In this article, the author, G. W. Fuchs, explains how these factors are handled at Corona Corp., the manufacturing division of Lightolier, Inc., where the purchasing department is a vital and necessary part of the corporate structure. Fuchs is a graduate mechanical engineer. He joined the firm in 1952 as a project engineer and transferred to purchasing in 1953. Here's how he defines his work: "My function is to translate the ideas of our artist-designers into produceable parts, locate sources for the parts, place the business, and follow through on expediting. In short, the function combines those of a design engineer, value analyst, buyer, and expediter."

these services, but they are generally more cumbersome to deal with because of their organizational structure. Often we are so pressed for time that we must have an extrusion die nearing tryout by the time an integrated company has assembled all the data to give us a quotation.

Where extensive vendor engineering services are required, the integrated companies are superior to the independents, and this factor cannot be ignored. We generally do not do business with those companies who market their own product and who are only selling excess press capacity to outside customers. It is felt that this practice would render our schedules too vulnerable for sound business.

Our extrusion vendors have to be of sufficient financial strength to carry out their commitments to us. If a Dun & Bradstreet report yields insufficient data, we make inquiries through other channels. We do not normally investigate a supplier's labor relations, nor do we feel it necessary to have more than one supplier for any given shape. We believe the effects of a supply breakdown, if necessary, can be counteracted by other vendors, since tooling time is generally short.

PURCHASING IS RESPONSIBLE

Since the vendor's performance is the responsibility of the Purchasing Department, selection of the vendor is left entirely to Purchasing, except in those rare specification jobs where the extruder is specified by the customer. Once the vendor has been tentatively selected from bids on preliminary drawings, contact between the vendor and the Design Engineering Department is established by Purchasing and maintained until satisfactory samples from production tools have been submitted.

In the interest of good communications, these contacts are never made without the presence of the responsible buyer, as only he has the right to commit the company to contractural obligations and it is his obligation to make sure that all specifications are understood. Inasmuch as we attempt to establish vendor relations for the long haul, we think that it is in our own interest not to subject a vendor to the penalty of an obvious underbid.

If we run across a quotation that is substantially below all others, we request that the low bidder, as well as the one or two bidders whom we know to be consistently in the right range, break down their quotations into three categories: (a) metal, (b) fabrication, and (c) finishing. This generally reveals where the error is by comparing the breakdowns among each other and sometimes with independently derived figures. We then advise the vendor to recheck his quotation and indicate where we think the error is. This type of analysis is usually appreciated and hardly ever abused.

This technique also is useful in bringing a high bid into line. Competitive figures are, of course, not revealed in either type of negotiation.

Once a plausible bid has been received, it is given to Estimating. If the final price departs considerably from the estimates, the Cost Accounting Department is notified as to the extent and the reason for the difference.

The actual purchase order usually is for a given number of pieces, or pounds, at a firm price, to be delivered in accordance with a schedule. Tools are to be used for us exclusively, and will be paid for after sample approval. Sometimes we are able to take advantage of the tool charge rebate incentives being offered by most companies.

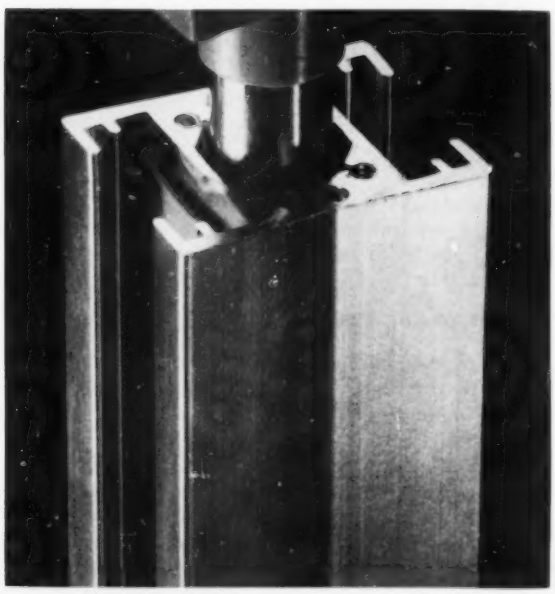
We do not believe that penalty clauses for failure to meet delivery schedules are too valuable, relying instead on close follow-up of the supplier by the buyer. This is a responsibility which, in our company, is not delegated to an expediter.

WHAT ABOUT REJECTS?

The satisfactory disposition of rejects is also the buyer's responsibility. He sees to it that the rejects are either returned for correction, or he obtains the supplier's authorization to scrap the material, making sure to obtain credits to indemnify the company for all losses for which it is not liable. The buyer must also make sure that proper precautions are taken to prevent recurrence of the condition causing material to be rejected.

It is our belief that, in buying extrusions as in all industrial buying, a clear understanding of the requirements as well as the willingness to do business between a vendor and our company is what generates a good relationship, and that these relationships ultimately benefit both parties. Thus, most of our purchase orders for extrusions are really confirmations which restate and clarify what has been understood long before the order was written. Of course, a purchase order is a legally-binding instrument. Nevertheless, most vendor-customer disagreements are solved by intelligent negotiations and good will by both parties.

That is why we channel the entire responsibility of vendor performance through one man, the buyer. It is up to him to take the steps necessary to keep material flowing into our factory on schedule, up to quality standards, and at a competitive price.



TYPICAL EXTRUSION purchased by Lightolier.

Iron Carbon System in Powder Metallurgy

Part 1: Quality of Iron Powder and Graphite

By P. ULF GUMMESON*

IS POWDER METALLURGY taking full advantage of the iron carbon system? We think not. While there are simpler combinations of materials that will give as good physical properties and dimensional control, in almost every case the raw materials are more expensive. We won't try to pinpoint the potential savings, if any, in using iron carbon. We will point out some of the advantages from a technical standpoint and, at the same time, mention some difficulties and how they can be avoided or overcome.

Figure 1 shows tensile strength of some common powder metallurgy mixes, with composition shown at the bottom of the graph. Three densities are reported for each composition. The iron is a sponge iron, the copper is of the reduced type, and the carbon is Bavarian 20 micron graphite. Sintering was done at 2070° F for 40 minutes in a roller hearth furnace in purified exogas with roughly 70% nitrogen, 21% hydrogen, and 9% carbon monoxide.

This atmosphere is on the lean side for sintering iron carbon. However, iron carbon in this case is stronger than iron and copper at practically any copper content. The only combination that is much stronger is 5% copper *and carbon* or infiltrated parts. With the help of a very rich sintering atmosphere, the strength of iron carbon under the same time-temperature conditions can be made to surpass anything but the infiltrated parts.

*HOEGANAES SPONGE IRON CORP.

TENSILE STRENGTH OF IRON POWDER PARTS

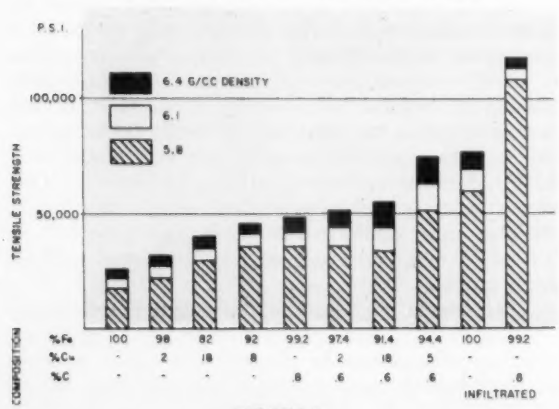


FIGURE 1.

For best results when using iron carbon, these factors should be controlled:

- Quality of the iron powder (reactivity, hydrogen loss).
- Quality of the graphite.
- Atmosphere composition.

QUALITY OF THE IRON POWDER

Reactivity is hard to define in terms of chemistry or physical properties. For example, it's easy to prove that cleanliness of the iron particle surface is important. An iron powder can be rendered non-reactive to carbon pickup by mixing in minute amounts of mineral dusts – amounts that would not be considered excessive as impurities.

Also, small amounts of alloying elements like manganese have a good effect on the reactivity with carbon. But it is not necessary or always desirable to have alloying elements, since these elements will often have other detrimental influences. However, oxide content is important. The major portion of the oxides in an iron particle must be reduced before the combination of iron and graphite can take place.

It is not necessary that the powder have a low hydrogen loss, although it's helpful. It is only important to know how much, so the proper amount of graphite will be mixed in. Usually, a eutectoid composition of about .8 – .9% is desired, so the graphite addition will have to be higher.

Figure 2 shows, in simple form, percent combined carbon after sintering versus percent graphite addition for an iron powder with .86% hydrogen loss. To get .9% combined carbon in this case, about 1.5% graphite should be added.

Figure 3 shows strength versus percent combined carbon. Maximum strength is obtained at eutectoid composition.

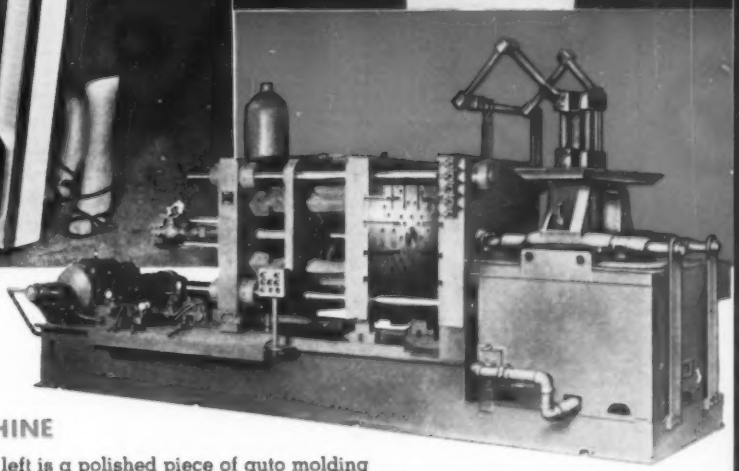
QUALITY OF THE GRAPHITE

One of the more confusing aspects of the system iron carbon is that, where graphite is concerned, reactivity again is important. Generally, the finer the particle size of any material, the higher is its reactivity. Not even this seems to hold true, except for one type of graphite. Some types combine easily with iron powder under adverse conditions; others refuse to do so except to a very limited degree.

What properties in the graphite make it suitable or

continued on page 58

HOLLAND DIE CASTING COMPANY, with skill and experience, produces extraordinary castings on B&T DIE CASTING MACHINES!



Joe: Better get the dope on these B&T machines Al.

CAST ON A 750-TON B&T MACHINE

1 The single finished part in the photo at the left is a polished piece of auto molding trim 64 inches long. It is produced in a two-cavity die weighing more than 8500 lbs. and measuring 84 inches in length. Weight of shot is 10½ lbs. Platens on the B&T machine are 48 inches wide and thus the 84 inch long die actually extends 1½ feet beyond each side of the machine. In successfully holding and casting this long piece the B&T 4-toggle lock-up system forcefully demonstrates its remarkable efficiency.

CAST ON A 750-TON B&T MACHINE

2 This intricate casting is the console of an automatic washing machine. The shot required weighs 14 lbs. Six 5 inch mounting studs in the back of the part are cast independently of the wall. The console has intricate coring and the instrument cluster is chrome plated and painted . . . a difficult casting to produce.

CAST ON A 600-TON B&T DIE CASTING MACHINE

3 This triangular-shaped casting is a chrome plated gravel guard for one of America's finest cars. It is made by the Holland Die Casting Company in a single cavity die weighing more than 6,000 lbs. Weight of the shot is 6½ lbs. Finish obtained is excellent. An outstanding production job for a 600-ton machine and indicative of the remarkable results obtainable with all B&T machines. Holland Die Casting Company's facilities include 12 B&T die casting machines in capacities up to 1,000 tons.

DIE RESEARCH: You are invited to use our Die Casting Research Center for experimentation and furtherance of die casting techniques.

B&T HYDRAULIC DIE CASTINGS TRIM PRESSES are exceedingly fast and efficient. Write for details.

Investigate B&T Die Casting Machines before buying any other. The line includes High-Pressure Cold-Chamber and Hot-Chamber types in capacities of 125, 150, 200,300, 400, 500, 600, 700, 800, and 1,000 tons. Write or phone for complete details.

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A DIVISION OF GREENLEE BROS. & CO., ROCKFORD, ILLINOIS

B & T MACHINERY COMPANY

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unsuitable are not known. However, a few points have been cleared up.

Table I lists a number of different grades of graphites and one iron sintered simultaneously at two different densities and at two different graphite additions. The actual values of dimensions, hardness, and strength are immaterial in this case. Only the comparative values to evaluate the various graphites are of interest. The synthetic graphites can be ruled out as unsuitable, although the reason is not clear.

NATURAL GRAPHITE IS BETTER

Natural and electrographites have the same crystal structure. One of the important differences is that the ashes in electrographites are mainly silicon carbide, and in natural graphite might be mica, clay, etc. Therefore, ash from electrographite might be worse (from a powder metallurgy standpoint) than ash from natural graphite.

Graphite can be rendered inactive in the presence of a molten phase. It's possible that the ash components in the graphite can form this molten phase and influence its reactivity.

Carbon black and lamp black are not very reactive, in spite of a particle size ranging from .5 – .005 micron. Also, they decrease compressibility. Carbon black, lamp black, and related products have a highly disordered lattice and an extremely fine crystal structure. One reason for their non-reactivity might be their high affinity for oxygen. Oxygen is strongly adsorbed on the crystal's surface with a bond that gets stronger at increased temperatures.

Graphites producing good results for hardness and strength are natural graphites from Ceylon-Madasgascar-Bavaria and Texas. The particle size, however, ranges from 5 microns to minus-100 mesh, and the ash content from 1.7% to 4.8%. Why they work is not clear, but it is possible to choose a suitable graphite among the many that do. Price also should be mentioned as a factor.

REQUIREMENTS FOR GRAPHITE

Here are some requirements for graphite:

- For mixing, an easily distributed graphite that gives good flow and widest range of mixed densities. The preference is for relatively coarse flaky graphite with good lubricity, not forgetting that graphite helps lubrication in pressing.
- For pressing, good lubricity, minimum briquetting pressure, and lowest green expansion. These rule out the synthetic graphites, soot, and all the high ash graphites.
- For proper sintering, high reactivity for fast reduction of oxides and fast carburization. This calls for natural graphites of low ash content – less than 5% – and fine particle size.

In short, we need a graphite that is below 100 mesh, of natural origin, flaky structure, and with low ash content.

Next month: Part II will be a continuation of this discussion, and will cover the effects of atmosphere composition.

CARBON CONTENT AFTER SINTERING
VERSUS
GRAPHITE ADDITION

Iron: Ancor 80 (.86% H_2 loss)
Graphite: Ceylon – 325 mesh
Sintering: 2050° F. (1125° C.)
Atmosphere: 28% CO +72% H_2
Test Bars: 1.250" x .500" x .250"
Density: 5.5 g/cc
6.2 g/cc

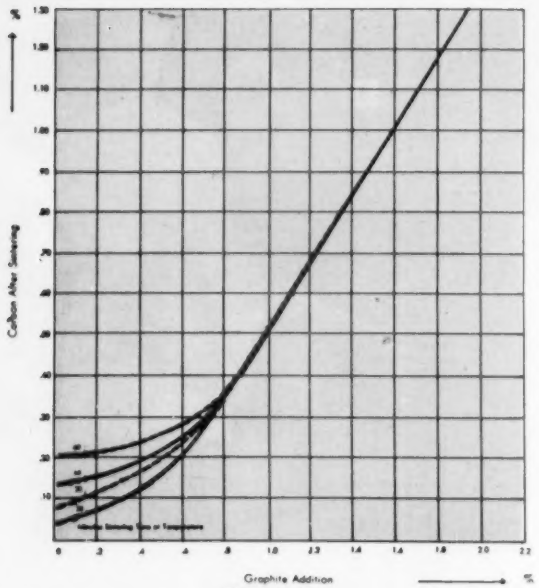

FIGURE 2.

TRANSVERSE RUPTURE STRENGTH
VERSUS
FINAL CARBON CONTENT (Combined)

Iron: Ancor 80 (.86% H_2 loss)
Graphite: Ceylon – 325 mesh
Sintering: 2050° F. (1125° C.)
Atmosphere: 28% CO +72% H_2
Test Bars: 1.250" x .500" x .250"
Density: 5.5 g/cc
6.2 g/cc

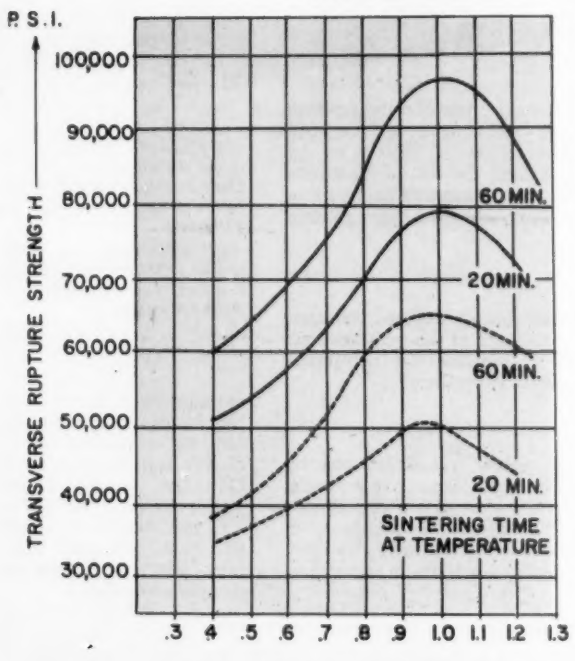

FIGURE 3.

TABLE I

Sintered Properties of Iron-Graphite Compositions

Influence of Graphite Quality

Rectangular bars, 1.250" x .500" x .250", sintered at 2070° F 35 minutes in an atmosphere of purified exogas. Production furnace.

			Dimensional Change, %				Hardness R_B				Modulus of Rupture P. S. I.			
Green Density g/cc			5.8		6.4		5.8		6.4		5.8		6.4	
Graphite Addition %			1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4
	Mfr. A													
1. Ceylon	5 Micron Average	2.8 Ash	.06	.10	.18	.19	27	22	53	52	51,400	53,300	72,200	83,000
2. Ceylon	10 Micron Average	2.2 Ash	.10	.06	.18	.21	24	4	51	47	46,600	44,100	70,100	80,600
3. Ceylon	97 % < 325 Mesh	5.2 Ash	.06	.06	.10	.15	17	16	41	49	39,300	43,900	63,700	65,300
4. Ceylon	97 % < 325 Mesh	3.5 Ash	.03	.18	.14	.22	–5	20	34	42	33,600	34,800	49,500	55,700
	Mfr. B													
1. Ceylon	5 Micron Average	1.7 Ash	.07	.14	.14	.23	22	28	50	55	49,600	56,700	74,100	81,900
2. Ceylon	20 Micron Maximum	1.7 Ash	.06	.14	.14	.26	17	24	45	55	42,100	51,800	72,500	80,800
3. Ceylon	20 Micron Maximum	2.9 Ash	.02	.18	.11	.30	17	36	46	62	47,100	53,800	70,400	81,200
4. Ceylon	98 % < 325 Mesh	1.5 Ash	.06	.21	.26	.14	8	37	44	57	36,500	53,700	72,000	80,000
5. Ceylon	100 Mesh, 60-75% < 325 Mesh	2.1 Ash	.10	.22	.24	.31	27	33	50	62	47,700	53,000	75,100	80,900
6. Madagascar	25 Micron Maximum	2.7 Ash	–.02	.13	.09	.28	14	37	46	61	48,100	53,100	70,000	83,300
7. Bavaria	20 Micron Maximum	3.8 Ash	.02	.09	.14	.17	22	33	53	57	48,800	54,500	72,900	88,900
8. Bavaria	20 Micron Maximum	4.2 Ash	.06	.10	.15	.23	21	35	51	61	50,300	58,900	72,700	89,300
	Mfr. C													
1. Texas	98 % < 325 Mesh	3.6 Ash	.16	.10	.10	.24	–8	15	22	56	34,000	39,000	56,100	73,000
2. Texas	95 % < 8 Micron	2.9 Ash	.07	.14	.09	.32	16	38	43	63	49,300	58,100	72,600	89,500
3. Texas	85 % < 2 Micron	3.5 Ash	.06	.22	.14	.22	23	37	52	62	46,900	46,900	73,500	91,800
	Mfr. D													
1. ?	60 % < 8 Micron	1.8 Ash	.06	.18	.14	.26	24	35	52	63	48,800	54,700	74,700	85,400
2. ?	99 % < 325 Mesh	4.8 Ash	.02	.03	.13	.14	20	17	51	48	47,800	51,400	72,000	79,600
3. ?	98 % < 325 Mesh	2.3 Ash	.05	.10	.10	.18	6	28	38	54	41,000	48,800	61,400	69,800
4. Mexican	70 % < 8 Micron	17.6 Ash	–.02	–.01	.10	.17	–24	–24	14	10	30,300	26,600	39,000	32,100
5. Mexican	99 % < 325 Mesh	18.9 Ash	.10	.18	.23	.39	–34	.32	6	6	21,700	19,400	32,800	25,400
6. Mexican	98 % < 200 Mesh	18.2 Ash	.23	.34	.42	.58	–49	–53	–6	–15	15,800	12,800	22,800	17,300
7. Mexican	98 % < 200 Mesh	18.9 Ash	.31	.47	.47	.58	–58	–64	–11	–19	14,000	11,100	20,000	15,600
	Synthetic													
1. Electro	Colloidal	.9 Ash	–.02	–.02	.10	–.06	–34	–24	6	12	20,600	——	31,300	——
2. Electro	25 Micron Maximum	1.0 Ash	.81	1.18	.62	.86	–22	–17	28	35	11,700	10,500	23,400	25,000
3. Electro	98 % < 325 Mesh	1.7 Ash	.81	1.11	.58	.82	–14	–4	35	42	13,000	12,500	27,200	27,700
4. Electro	98 % < 200 Mesh	1.6 Ash	1.00	1.43	.78	1.07	–24	–27	24	32	9,100	9,300	22,000	22,400

Metallurgy of Die Cast Aluminum Alloys

By WALTER BONSACK*

MOST aluminum casting alloys can be die cast. This bold statement does not mean that they are. In fact, only a few alloys are die cast. All alloys which are difficult to cast in sand or permanent mold are automatically excluded from diecasting. The reason is more economical than metallurgical, because with great care even the difficult alloys can be cast.

Since die casting dies are rigid, they demand alloys which have the least possible shrinkage and are free from hot cracking. The Al-Si alloys fulfill these requirements best of all and they are therefore in general use. Copper additions to these alloys in ranges up to 4% give quite good castability and alloys of the Al-Si-Cu series are most commonly used due to their greater availability and lower cost. They are followed by a 13% silicon alloy and then by a 10% silicon 0.5% magnesium alloy. The least used, because of the difficulties encountered in casting, is an 8% magnesium-aluminum alloy. New alloys also being die cast are the high silicon alloys with up to 25% silicon.

Castability, or fluidity, is not too great a factor because the high pressures used in die casting help overcome any lack of it. Still, it is desirable when filling thinner sections. Again, the high silicon alloys fulfill this requirement.

These general considerations lead to the alloy specification of the die casting alloys used in this country. ASTM specification B85-58T gives not only the chemical requirements but also the mechanical properties obtained, the die casting characteristics, and other data. Tables I-III give this information.

To discuss the metallurgy of die casting alloys, the composition of the alloys has to be scrutinized. Wherever a range is given in the specification, it means a desirable element is involved. Less desirable elements are noted by giving a maximum figure which is permissible.

It will be noted that silicon is desired in most alloys except the aluminum-magnesium alloy. Copper and silicon form another group. In those which designate a low maximum figure for copper, it is not desired because its presence increases corrodability of the alloys.

The only other element which shows a range or desirability is magnesium. Outside of being the main alloying element in alloy G8A, it is also desired in alloys SG100A and B. The magnesium content in the latter alloy is said to improve the yield strength of the alloy without loss of ductility. In all other alloys the magnesium content is held to 0.10% maximum.

This is quite important. It does not appear reasonable to assume that a 10% silicon can advantageously have 0.50% magnesium while a 13% or 5% silicon should suffer loss of some properties if the magnesium content were as high as 0.60% magnesium. Even in the copper-bearing aluminum-silicon alloys, a higher magnesium content should not unduly change the mechanical properties.

The only reasoning seems to be that magnesium, since it oxidizes more easily than aluminum, will cause casting difficulties. But even these should not be too great. In Germany, for example, die casting alloys allow magnesium up to 0.5% in aluminum-silicon and aluminum-silicon-copper alloys. Turbulence in the die causes an intimate mixture of air and oxidizable magnesium which can be and has been con-

continued on page 62

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ALUMINUM AND MAGNESIUM INC.

FIGURE 1. Four different charges, numbered 4, 3, 2, 1 (left to right).

TABLE I — CHEMICAL REQUIREMENTS[a, b]

Alloy[c, d]	Aluminum, per cent	Copper, per cent	Iron, max, per cent	Silicon, per cent	Manganese, max, per cent	Magnesium, per cent	Zinc, max, per cent	Nickel max, per cent	Tin, max, per cent	Other Constituents, Except Aluminum, max, (Total) per cent
G8A	remainder	0.25 max	1.8	0.35 max	0.35	7.5 to 8.5	0.15	0.15	0.15	0.25
S5C	remainder	0.6 max	2.0	4.5 to 6.0	0.35	0.10 max	0.50	0.50	0.15	0.25
S12A	remainder	0.6 max	1.3	11.0 to 13.0	0.35	0.10 max	0.50	0.50	0.15	0.25
S12B	remainder	0.6 max	2.0	11.0 to 13.0	0.35	0.10 max	0.50	0.50	0.15	0.25
SC84A	remainder	3.0 to 4.0	1.3	7.5 to 9.5	0.50	0.10 max	1.0	0.50	0.35	0.50
SC84B	remainder	3.0 to 4.0	2.0	7.5 to 9.5	0.50	0.10 max	1.0	0.50	0.35	0.50
SC114A	remainder	3.0 to 4.5	1.3	10.5 to 12.0	0.50	0.10 max	1.0	0.50	0.35	0.50
SG100A	remainder	0.6 max	1.3	9.0 to 10.0	0.35	0.40 to 0.6	0.50	0.50	0.15	0.25
SG100B	remainder	0.6 max	2.0	9.0 to 10.0	0.35	0.40 to 0.6	0.50	0.50	0.15	0.25

[a] Analys's shall ordinarily be made only for the elements mentioned in this table. If, however, the presence of other elements is suspected, or indicated in the course of routine analysis, further analysis shall be made to determine that the total of these other elements does not exceed the amount given in the last column.

[b] For purposes of acceptance and rejection, the observed value or calculated value obtained from analysis should be rounded off to the nearest unit in the last right-hand place of figures, used in expressing the specified limit, in accordance with the rounding-off procedure prescribed in Section 3 of the Recommended Practices for Designating Significant Places in Specified Limiting Values (ASTM Designation: E 29).

[c] Alloys G8A, S5C, S12B, SC84B, and SG100B are suitable for the production of die castings by either the goose neck or the cold-chamber process. Die castings of alloys S12A, SC84A, SC114A, and SG100A may be made only in cold-chamber machines.

[d] These alloy designations were established in accordance with the Recommended Practice for Codification of Light Metals and Alloys, Cast and Wrought (ASTM Designation: B 275).

TABLE II — DIE CASTING AND OTHER CHARACTERISTICS

Alloy	Approximate Melting Range, deg Fahr	Die Casting Characteristics			Other Characteristics									
		Resistance to Hot Cracking[a]	Pressure Tightness	Die Filling Capacity[b]	Normally Heat Treated[c]	Resistance to Corrosion[d]	Machining[e]	Polishing[f]	Electroplating[g]	Anodizing Appearance[h]	Chemical Oxide Coating[i] (Protection)	Strength at Elevated Temperature[j]	Suitable for Welding	Suitable for Brazing
G8A	995 to 1150	5	5	5	—	1	1	1	5	1	1	4	No	No
S5C	1065 to 1170	2	3	3	—	2	5	4	2	4	3	5	No	No
S12A	1065 to 1080	1	2	1	—	3	4	5	3	5	3	3	No	No
S12B	1065 to 1080	1	2	1	—	3	4	5	3	5	3	3	No	No
SC84A	1000 to 1100	2	2	2	—	5	3	3	1	3	5	2	No	No
SC84B	1000 to 1100	2	2	2	—	5	3	3	1	3	5	2	No	No
SC114A	960 to 1080	2	2	1	—	5	3	3	2	4	4	2	No	No
SG100A	1035 to 1105	1	1	1	—	3	3	3	1	3	3	2	No	No
SG100B	1035 to 1105	1	1	1	—	3	3	3	1	3	3	1	No	No

[a] Ability of alloy to withstand stresses from contraction while cooling through hot-short or brittle temperature range.

[b] Ability of liquid alloy to flow readily in die and fill thin sections.

[c] Heat treatments generally confined to low-temperature to provide stress relief or increased ductility. Treatments to improve properties not generally applicable.

[d] Based on resistance of alloy in standard type salt spray test.

[e] Composite rating based on ease of cutting, chip characteristics, quality of finish and tool life.

[f] Composite rating based on ease and speed of polishing and quality of finish provided by typical polishing procedure.

[g] Ability of the die casting to take and hold an electroplate applied by present standard methods.

[h] Rated on lightness of color, brightness and uniformity of clear anodized coating applied in sulfuric acid electrolyte.

[i] Rated on combined resistance of coating and base alloy to corrosion.

[j] Rating based on tensile and yield strengths at temperatures up to 500 F, after prolonged heating at testing temperature.

TABLE III—TYPICAL MECHANICAL PROPERTIES OF TEST SPECIMENS

Alloy	Tensile Strength, psi	Yield Strength (0.2 per cent Offset), psi	Elongation in 2 in., per cent	Shear Strength, psi	Fatigue Strength (R. R. Moore Specimen), 500,000,000 Cycles, psi
G8A[a]	———	———	—	———	———
S5C	33 000	14 000	9.0	19 000	17 000
S12A	42 000	19 000	3.5	25 000	19 000
S12B	43 000	21 000	2.5	25 000	19 000
SC84A	47 000	23 000	3.5	27 000	20 000
SC84B	46 000	23 000	2.5	28 000	20 000
SC114A	48 000	24 000	2.5	29 000	20 000
SG100A	46 000	24 000	3.5	26 000	18 000
SG100B	44 000	25 000	2.5	28 000	20 000

[a] The mechanical property data for alloy G8A are in the process of being accumulated.

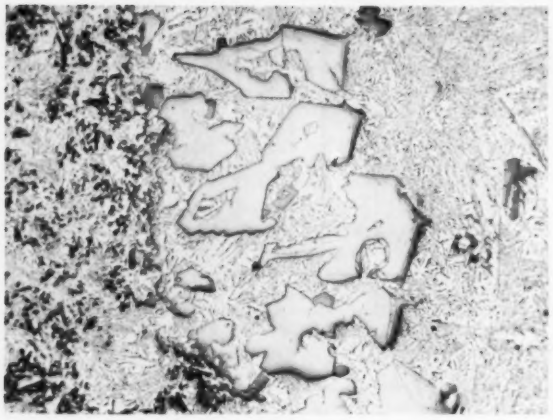

FIGURE 2.

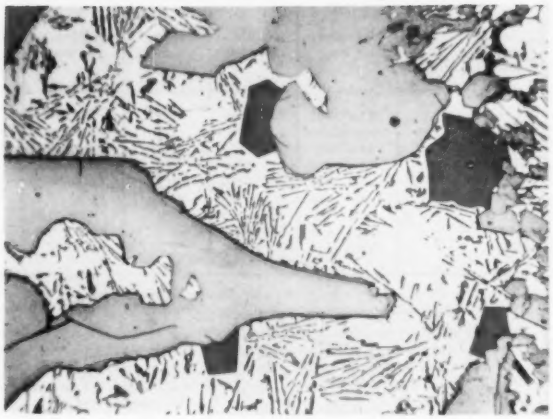

FIGURE 3.

ALUMINUM ALLOYS *continued*

siderably minimized today by the vacuum die casting process. Alloys with considerably higher magnesium content are being cast successfully. Therefore, it seems that the magnesium content in these alloys should be critically appraised again by the die casting industry.

IRON CONTENT OF DIE CASTING ALLOYS

It is generally accepted that the iron content of die castings has to be on the high side, in fact higher than in sand or permanent mold alloys, because iron is said to prevent the sticking or soldering of the casting to the die. Sticking to the die is not only bothersome by causing scrap. It may even necessitate closing down the die and carefully removing the metal, which has soldered to the die. This in itself is an expensive process, not counting the loss of production. As a high iron content prevents sticking, or at least diminishes its occurrence considerably, it is a desirable element.

As the mechanical properties are still quite high even with such high iron contents, there should be little objection to using it. Iron is demanded within certain specific ranges by some die casters.

Unfortunately, iron forms a high-melting, complex compound with aluminum and other elements like manganese-silicon and chromium. Also, being of higher specific gravity than the parent metal, it has a tendency to settle out and concentrate in the bottom of the furnace at the pouring temperatures used in die casting. This is shown by the following illustrations.

Figure 1 represents four different heats of a 13% silicon die casting alloy containing 1% iron. Charge 1 on the right was melted at 1350° F and then solidified. Charge 2 represents the same alloy melted at 1350° F but then allowed to stand at 1200° F for 1 hour, charge 3 for 2 hours, and charge 4 for 3 hours. These miniature furnace charges were cut through the center and machined as shown in the photograph. The results reveal the iron segregated quite freely. The charge melted at 1350° F showed no indication of segregation. The charges kept for 1, 2, and 3 hours show a line of demarkation (as shown by arrows). Analysis of these charges proved that iron, manganese, and chromium had migrated toward the bottom of the furnace. Analysis of the three areas A, B, and C indicated, for example, in charge 1:

1 hour at 1200°F	Cu	Si	Fe	Zn	Ni	Mn	Ti	Cr
Zone A	0.37	11.40	2.70	0.18	0.03	0.75	0.06	0.38
Zone B	0.40	11.00	0.77	0.17	0.03	0.11	0.07	0.09
Zone C	0.40	11.00	0.70	0.17	0.03	0.10	0.07	0.05
Melted at 1350°F								
Zone A	0.35	10.44	0.71	0.16	0.02	0.12	0.06	0.07
Zone B	0.40	10.50	0.81	0.17	0.03	0.14	0.07	0.07
Zone C	0.35	10.60	0.71	0.16	0.02	0.12	0.07	0.07

The comparisons of analyses show that, at 1200° F, iron, manganese, and chromium segregate. Nickel, titanium, and copper do not participate in this segregation.

Microscopic analysis confirms these results. Figure 2 is a photomicrograph showing the three distinct zones at 25X. The left area shows the accumulation of iron complex crystals which are relatively fine. However, from this area grow large iron complex crystals and, finally, the low iron area is at the right. Figure 3 gives the transition zone at 100X and it shows clearly how large these crystals grow. The dark grey crystals are primary silicon. The light grey, (the "hard spots") are the aluminum-iron-manganese-chromium complex crystals. Figure 4 (100X), representing the alloy when processed at 1350° F, shows the iron evenly distributed throughout the mass in form of "Chinese script," a very desirable form of iron crystals. Figure 5 shows at 400X, a large complex iron crystal found in a die casting which was troubled with hard spots, i. e., excessive tool wear and badly machined surfaces.

The segregation problem is caused by the low pouring temperatures commonly used in die casting. The temperatures are low enough to allow the iron constituent of the alloy to crystallize out and settle to the bottom. Agitation by the pouring devices will transfer solid crystals into the casting, causing hard spots if they had a chance to grow objectionably large.

Many die casters add ingot metal to the melting pot as they pour castings. Due to the low temperature of the molten metal, the iron compounds contained in the ingot do not melt at all, but settle as such to the bottom of the furnace and accumulate there. This

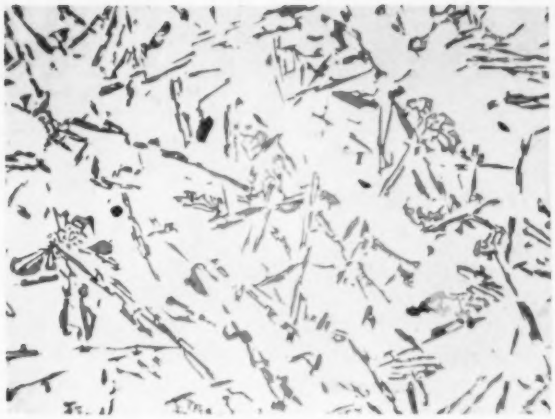

FIGURE 4.

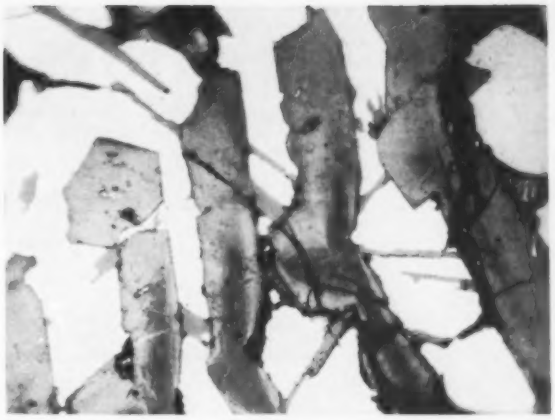

FIGURE 5.

saturation will cause greater chances for hard spot difficulties.

With the introduction of high silicon alloys in which silicon is above 12% to 25%, another type of segregation is encountered in addition to the iron segregation. At the pouring temperatures employed by die casters, the silicon will crystallize out. Being of lower specific gravity, it will rise to the top of the melt. According to the equilibrium diagram of aluminum-silicon alloys at 1200° F, only about 15% silicon can be held in solution in the liquid metal. Any excess above this amount will crystallize out and migrate upward.

So, having three layers in a furnace can easily happen. The upper portion will have a very high silicon, the bottom portion high iron, and a layer of alloy much lower in both silicon and iron in between. This is illustrated in Figure 6, which represents a melt of a 22% silicon alloy which had been heated to 1500° F and then cooled to room temperature in the crucible. During the short time of cooling, the silicon segregated upward and the iron downward.

Figure 7, a photomicrograph at 200X, shows a die casting of a 22% silicon alloy. The casting was successfully made at 1250° F, although the liquidus temperature is about 1390° F. Since the solidus or eutectic temperature is about 1070° F, there is a temperature range of roughly 300° in which primary silicon will crystallize out. This actually happened in this casting, since two sizes of primary silicon can be found. The relatively large plates of silicon were formed in the furnace before pouring, and the small silicon plates in the casting after pouring. There is no doubt that the smaller form is more desirable, since large silicon crystals constitute a machining problem due to their hardness.

Both iron and silicon behave quite similarly. Their contribution to difficulties can be remedied easily by using the proper pouring temperatures. However, higher temperatures are not desirable because of the accompanying loss of production. There is, of course, one marked difference between silicon and iron. Silicon, being on the top of the melt, will constantly be removed and will not accumulate to such an extent as iron. Iron settling out in the bottom must be removed periodically by raking the iron crystals out or the difficulties with hard spots increase rapidly.

FIGURE 6.

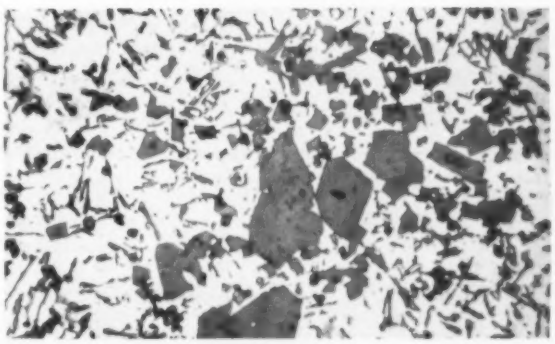

FIGURE 7.

Tool Steels and Heat-Treatments For Steel Extrusions

The development of satisfactory lubricants has made the extrusion of steel practical. Solid and hollow shapes can be made economically. Most steels are extruded at temperatures from 2200°F to 2300°F, and at speeds considerably higher than those used for any of the other metals commonly extruded. This combination of speed and temperature puts a severe strain on the strength and heat resistance of the steels. Carefully made dies, free of all local stress risers and properly heat-treated must be used for successful extrusion.

AISI Type	Preheat	High Heat	Quench	Temper	Brinell	Rockwell-C
EXTRUSION DIES FOR ROUNDS, SHAPES, AND TUBES						
H-22	1500 F	2150 F	Oil & Air	1250 F	319/336	34/36
H-22	1500 F	2150 F	Oil & Air	1300 F	319/336	34/36
Rexalloy A*	No heat treatment necessary — Furnished about Rockwell C 4-/44					
Rexalloy 33**	No heat treatment necessary — Furnished about Rockwell C 54/58					
BACKER BLOCKS AND DIE HOLDERS						
H-12	1400 F	1850 F	Air	1100 F	371/390	40/42
H-22	1500 F	2150 F	Oil & Air	1200 F	371/390	40/42
LINERS AND RAMS						
H-11	1400 F	1800 F	Air	1125 F	362/381	39/41
H-12	1400 F	1850 F	Air	1100 F	371/390	40/42
DUMMY BLOCKS						
H-12	1400 F	1850 F	Air	1100 F	371/390	40/42
H-21	1500 F	2150 F	Oil & Air	1200 F	371/390	40/42
MANDRELS						
H-11 water cooled	1400 F	1800 F	Air	1100 F	400/421	43/45
H-21 oil cooled	1500 F	2150 F	Oil & Air	1200 F	371/390	40/42

(Note: above 3" diameter mandrels, lower hardness to Rockwell C 39/41)

Grade	Typical Composition			
	C	W	Cr	Co
*Rexalloy A	1.20	4.5	28.0	65.0
**Rexalloy 33	2.25	17.0	33.0	44.0

Data courtesy, Crucible Steel Co. of America

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Investment Casting in Shell Molds

Part 1: Silicate shells

By PAUL E. SCHLINKMANN*

NALCAST is a siliceous material with a low coefficient of expansion developed by Nalco Chemical Co. Used with Nalcoag liquid binder to make a variety of thermal shock resistant ceramic shapes, it's available in several grinds prepared specifically to make ceramic shell molds for the investment casting industry.

These grinds include:

- Nalcast P-1, a powder to be mixed with Nalcoag liquid to make a thick slurry for inner coats. Specially-graded particle sizes give velvet-smooth surfaces.
- Nalcast S-1, a fine stucco grain to be applied to inner coats.
- Nalcast P-2, a powder coarser than P-1, to be mixed with Nalcoag liquid to make a thin slurry for outer coats.
- Nalcast S-2, a coarse stucco grain for outer coats.

The approximate compositions of the P-1 and P-2 slurries are given in Table I.

Ceramic shell molds are easy to make. The pattern is dipped into a slurry and sanded. The first coat is dried thoroughly. Intermediate coats can be applied as quickly as the previous one is firm enough to prevent sloughing. After the last coat, the mold is dried thoroughly.

The properly-cleaned wax pattern assembly is first dipped in the P-1 slurry and stuccoed lightly with the S-1 grain. The first coat must be completely dried, taking at least 2 hours under average winter indoor humidity conditions. Mechanical heater blowers with accurately-controlled wet and dry bulb temperatures can reduce this time considerably.

The second coat is applied from the same P-1 slurry directly after dipping the cluster into a wetting solution and draining for about 5 seconds. This wetting solution is used only between the first and second coat, and permits using the heavy P-1 slurry for the second coat. The S-1 grain is used on this coat also, this time with a heavy application.

After two inner coats, two to four outer coats may be applied from the P-2 slurry, stuccoing each heavily with the S-2 grain. The number of coats necessary depends on several factors, such as the head of metal that the mold must hold, special contours and gating configuration, and whether it is to be poured unsupported or to be backed up with shot or sand.

The thickness, and therefore the strength, of the outer coats can be varied by the degree that each slurry is allowed to drain off before the stucco grain is applied. Until a background of experience has been built up, each cluster should be tried several ways to determine the optimum for that cluster. Five coats is a good starting point for an unsupported shell to be poured with a metal head of less than 10 inches.

The rate of applying outer coats is limited only by making certain it won't cause a previous coat to slough. This will vary for different shapes and humidity. Generally, these outer coats may be applied from 20 to 50 minutes apart when the humidity is between 20 and 50% and the patterns don't have deep recessed cores. The third and fourth coats may be applied more rapidly than the fifth or sixth coats.

After the last coat is applied, the assembly must be dried thoroughly before dewaxing. There is no simple test to determine when a shell is dry, and experience alone will tell. If castings have rough surface spots or considerable plus metal in recessed areas, with good surfaces in other areas, then it's almost certain the recessed areas were not thoroughly dry before dewaxing.

*TECHNICAL REPRESENTATIVE
NALCO CHEMICAL CO.

EDITOR'S NOTE: Improved metallurgical properties, lower-cost molds, and faster production rates are benefits gained by using shell molds in the investment casting industry.

Don't confuse shell molds in investment casting with the "shell mold casting" process. Wax or plastic patterns are still used and the mold is applied to the pattern at room temperatures. None of the advantages of investment casting are lost, and some outstanding ones have been added.

Almost every company investigating shell molds has come up with a different mold material. All of them have points in common. The shell is highly refractory, quite porous, relatively thin, self supporting, and it can be applied quickly so that the time from completed wax pattern to pouring the metal is cut drastically.

The present state of the art is typified by three different reports. They describe silicate shells, aluminum oxide shells, and special glass-like shells. Although there are many other materials and mixtures in current use, we believe these three reports will cover, very broadly, all general procedures and techniques.

The first of these reports, covering silicate shells, is presented here, and the other two will appear in subsequent issues of PRECISION METAL MOLDING.

Excessive temperature variations between the start of applying the first coat and the time that the shell is dewaxed can cause the shell to crack. More than 10 degrees variation may cause trouble. Rising temperatures, because of wax expansion, are more harmful than falling temperatures. After dewaxing, the shells are stable for any degree of temperature change.

DEWAXING, POURING

With conventional pattern waxes that expand up to 12% over the 75 - 175° F range, an easy way to dewax is to shock heat the cluster so that an outer thin film of wax melts almost instantly before the mass of wax can expand and exert enough pressure to crack the shell. Consequently, gates and runners, wherever possible, should be hollow and of softer wax than the pattern proper. On very large pieces, the pattern sections themselves should be hollow if possible.

Shock heating can be done by inserting the cluster into a furnace previously heated above 800° F. Depending on the nature of the pattern material and on the particular contours of the pattern cluster, there may be a different minimum temperature to which different clusters must be exposed in order to relieve quickly the stresses resulting from wax expansions at enough points so that the shell will not crack. However, thermal shock alone will not crack the shell even if temperatures up to 2000° F are used in dewaxing.

Following dewaxing, the shell must be fired enough to burn off carbon completely. With a sufficiently oxidizing atmosphere, this may be complete in 15 minutes at 1400° F. The shell may be removed from the hot firing oven and cast directly or it may be removed and allowed to cool in the air without danger of cracking. It can be stored and reheated later, or it may be poured cold.

Small shells for 4 lb of metal and under may be held by the sprue cup with a pair of tongs and the metal poured directly into the shell in the open. Medium size pieces may be supported on fire brick or sand, while larger pieces, 30 lb and up, may have to be embedded in sand.

While the permeability of Nalcast shells is good, it is too much to expect very thin sections to fill out perfectly if the shell is in contact with too cold a support. In order to realize the most in metallurgical properties of the particular alloy being poured, the lowest possible shell and metal temperatures should be used.

Dimensional change from wax pattern to casting will differ from conventional investment molds. Lengthwise shrinkage is about 2.5%. Thickness of thin flat sections may be greater in the casting than the pattern. However, once determined, the shrinkages should be uniformly reproduceable.

FORMING CORES

Large-diameter, open-end cores are no problem to make the same way as the rest of the ceramic shell. In other cases, cores of certain dimensions may plug up after the first coat, or have shapes that make it impossible to apply stucco. A gelling technique must then be used to hold the slurry in the core.

The problem of drying a gelled water binder from within a deep core in a wax pattern is a difficult one. Because alcohol is much more volatile than water, it is possible to free an alcoholic hydrolized ethyl silicate binder of its alcohol vehicle from within deep cores in wax patterns without breaking or warping the core.

To do this, cores are formed first from a Nalcast refractory and an ethyl silicate binder within each wax pattern. For more difficult cores, this may be done even before the patterns are clustered. The ceramic shell is then formed around the patterns with their filled cores in the usual manner.

The materials required include:

- Binder – ethyl silicate-40.
- Vehicle – F-30 denatured alcohol.
- Hydrolizing agent – 3% hydrochloric acid.
- Gelling agent – 10% water solution of ammonium carbonate.
- Refractory – Nalcast, mixtures of the four grades (P-1, P-2, S-1, S-2).

The binder must be prepared ahead of time and put in closed containers. It will keep a week or two. Each 100 ml. of the hydrolized ethyl silicate is made by mixing 2.6 ml. of the 3% hydrochloric acid with 59.8 ml. of the F-30 alcohol and adding 37.6 ml. of the ethyl silicate-40. Normally, the temperature of

continued on page 103

TABLE I

COMPOSITION OF SLURRIES

For a slurry volume 8 in. in diameter by 6¾ in. deep, approximately 5.5 liters or 1.5 gallons:

P-1			
Nalcoag 30%	2.6 qt. =	6 lb. 10 oz. =	2500 ml.
Nalcast P-1		15 lb. =	6800 grams
Antifoam B			4 drops
Ultrawet 60L		15 grams =	15 ml. max.

P-2			
Nalcoag 30%	3.3 qt. =	8 lb. 5 oz. =	3150 ml.
Nalcast P-2		12 lb. 2 oz. =	5500 grams

No wetting agent or antifoam is used here.

The P-1 slurry is based on the ratio of Nalcast/Nalcoag = 275 grams/100 ml.

The P-2 slurry is based on the ratio of Nalcast/Nalcoag = 175 grams/100 ml.

For a slurry volume 18 in. in diameter by 15 in. deep, approximately 16.6 gallons:

P-1			
Nalcoag 30%	7.5 gal. =	75 lb. =	28,400 ml.
Nalcast P-1		172 lb. =	78,000 grams
Antifoam B			2 to 3 ml.
Ultrawet 60L		170 grams =	170 ml. max.

P-2			
Nalcoag 30%	9.5 gal. =	95 lb. =	36,000 ml.
Nalcast P-2		139 lb. =	63,000 grams

No wetting agent or antifoam is used here.

NOTE: Nalcoag 35% may be substituted for the 30% in all the above formulas.

Wetting Solution: Nalcoag, with no solids, but with 0.5% Ultrawet 60L by volume.

Die steels improved with . . .

New Vacuum Degassing Process

THE CURSE of the die casting and extrusion industries is premature die failure. These failures generally occur for no apparent reason. Loading may be normal, both die and metal temperatures correctly controlled, rates of production normal, the proper lubricant used. In short, everything under good control. Still the die failed. What's the cause? It could be high hydrogen content of the steel.

Minute amounts of hydrogen dissolved in solid steel often causes delayed internal rupture. These internal ruptures are believed to result from the formation of hydrides in the solid steel and the precipitation of the hydrides at the grain boundaries.

When this grain boundary failure occurs, local areas of high stress concentrations are set up and the steel fails under normal working stresses.

How much hydrogen is dangerous? Apparently any amount over 2.5 parts per million (ppm). This minute amount is easily picked up from moisture in the air during melting. Even when a good slag cover is used there is enough diffusion of the hydrogen through the slag to give a hydrogen content in the solid steel of 3.9 ppm or more.

If the hydrogen is such a "bad actor" it should be removed. There are several ways to do this, but the best so far is by vacuum treatment of the molten metal. Broadly, there are four general methods which are commercially successful: Vacuum arc melting, vacuum induction melting, vacuum stream degassing, and ladle degassing.

No one of these methods is best. Each must be evaluated in terms of the end use of the steel and the plant in which the steel is made.

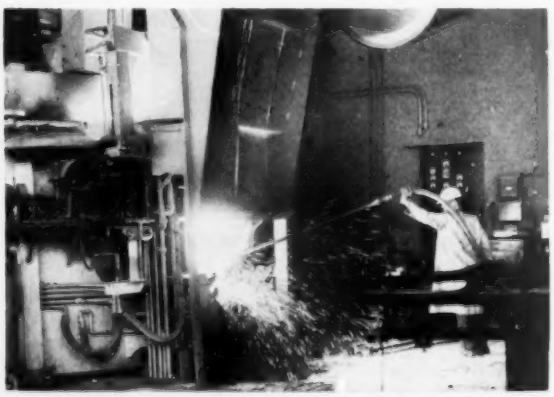
One of the highly successful methods for lowering the hydrogen content of alloy steels is ladle degassing, developed by A. Finkl & Sons Co. In this method, a full heat of 75,000 lbs. of tool steel can be treated so that the hydrogen content of the solid metal is not over 1.5 ppm. The method is fast, effective, and has one outstanding advantage which no other process has. As few, or as many, individual ingot molds can be poured as desired. This contrasts with vacuum arc melting, where only a single ingot can be made, and with vacuum degassing where only one or two ingots can be teemed from a single melt.

Here's how ladle degassing works:

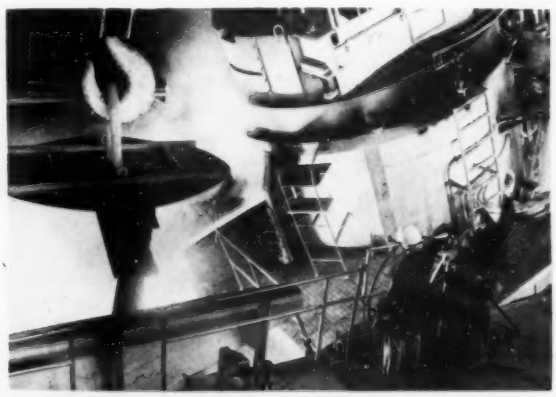
A full heat of 75,000 lbs. of steel is skimmed to remove almost all the slag and then poured into a ladle. The molten steel, at about 3000°F, is then moved to a vacuum chamber. Both ladle and contents are placed in the chamber, which is then closed and sealed. The air is evacuated from the chamber and when the pressure has been sufficiently reduced, helium is bubbled through the melt. A fairly violent boil results. This thoroughly stirs the molten steel and, at the same time, the helium acts as a scavenger to help remove dissolved hydrogen, nitrogen, and oxygen. When gas evolution has stopped and the metal is thoroughly degassed, the vacuum pumps are shut off and the chamber brought up to atmospheric pressure. The metal is now ready for teeming. A schematic diagram of the process is shown in Figure 1.

The entire degassing operation takes about 12 minutes from the time the ejectors start to lower the chamber pressure until the degassing is completed. Four stage steam ejectors are used to lower the chamber pressure during degassing to about 0.5 mm of mercury. While the ejectors are capable of lower pressures, the blank-off pressure being 70 microns, experience has shown that 0.5 mm is low enough.

In addition to lowering the incidence of internal cracks, this vacuum degassing operation materially improves the ductility of the steel without lowering either the ultimate tensile strength or the yield strength appreciably. Typical tensile tests on nickel-chromium-molybdenum steels, together with hydrogen content,



OXYGEN is injected into a heat of nickel alloy steel.



TAPPING FURNACE, 75,000-lb heat goes into the ladle.

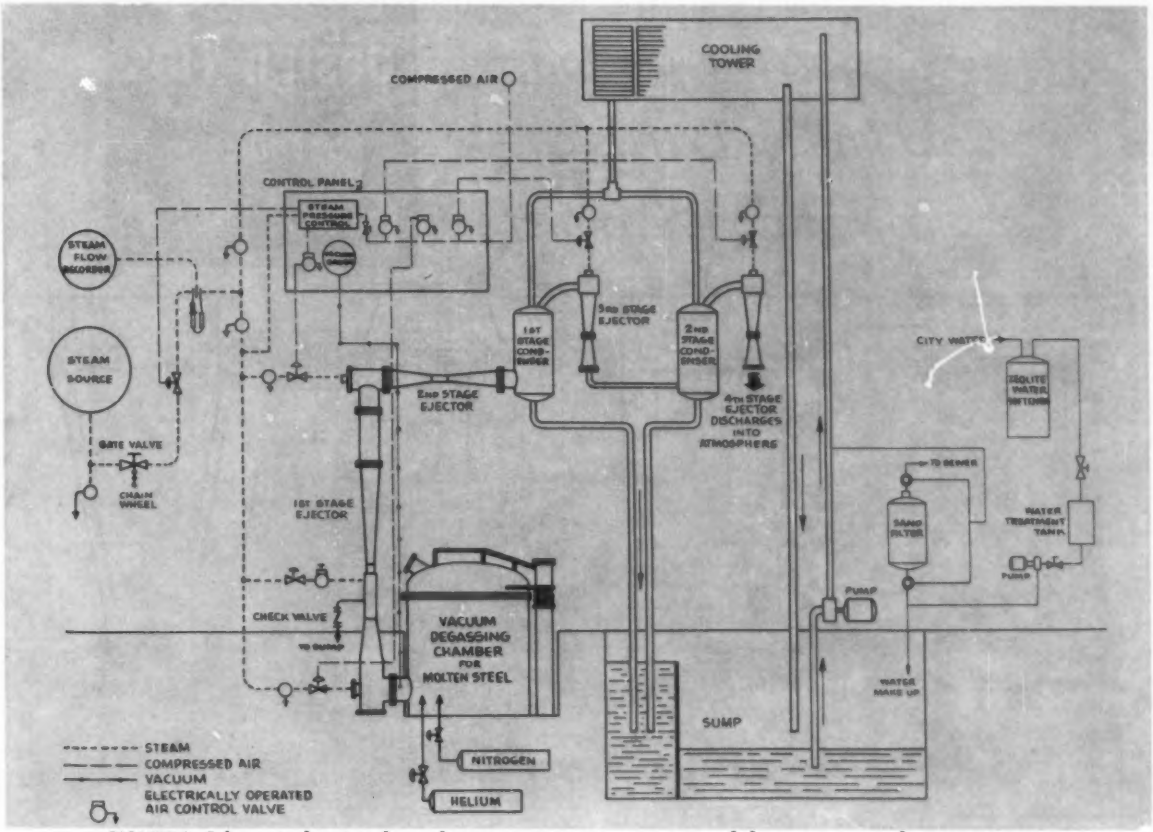


FIGURE 1. Schematic drawing shows the steam ejection pump system of the new vacuum degassing process.

are shown in Table I. The results given are the averages of duplicate tests on standard tensile test bars cored from 12"x12"x32" forged blocks. Heat treatment was identical for all test bars and special precautions were taken during machining and storage to minimize hydrogen losses. The improvement in ductility is evidenced by increases in both elongation and reduction in area, 43% and 86% respectively. The change in strength is less than 4% and is an increase for degassed steel.

In addition to decreasing the incidence of microcracking at the grain boundaries, this method of degassing seems to decrease heat checking, a major cause of die casting die failures. Naturally, much evaluation work remains to be done before the full potentialities of vacuum degassed steel are known. However, enough work has been done to indicate that degassed die steel will have a greater service life in both die casting and extrusion to justify its use.

All the methods for preparing low gas content steel will increase its cost. But in no case is this increase significant. Almost all the cost of a die casting or extrusion die is in labor, so that an increase in the cost of steel would have to be quite large before it has much effect on the final die cost. None of the methods in current use increase costs to any appreciable extent.

QUIET SURFACE shows on steel after it is degassed.

TABLE I

EFFECT OF DEGASSING ON TYPICAL TOOL STEEL

Heat No.	Degassed	Strength x 1000		Ductility %		Hydrogen ppm*
		Tensile	Yield	Elong.	Red. of Area	
X-1573	No	167.5	141.6	10.0	19.2	3.0
X-1607	Yes	168.5	145.2	15.0	41.8	1.7
X-1612	Yes	166.0	141.2	15.8	42.6	1.4
X-1618	No	164.0	140.0	11.5	26.1	3.0

*ppm — parts per million

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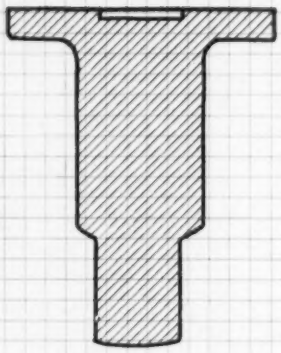
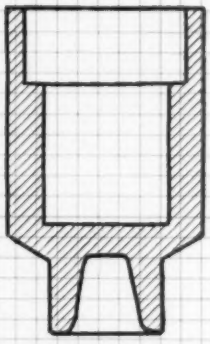
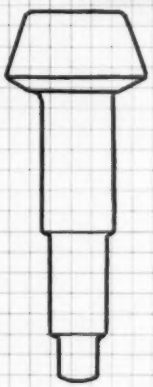


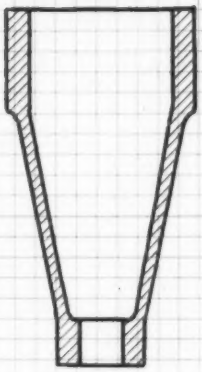
Solid and hollow flanged parts



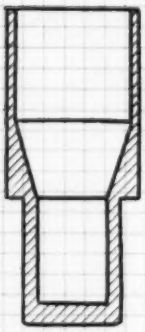
Cylinders with internal and external embossments



Solid and hollow flanged parts

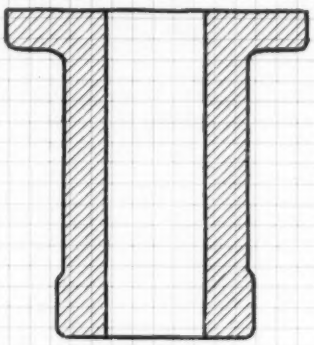


Ogives and conical shapes



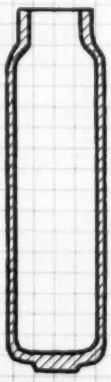
Cylindrical bodies

Geometric shapes



Undercut diameters

Geometric shapes



Cylinders with internal and external embossments

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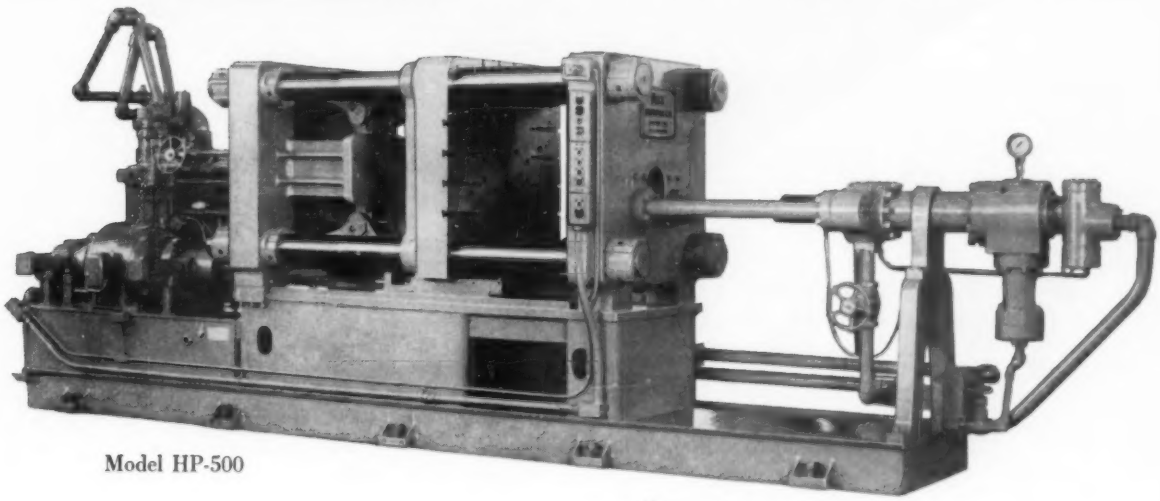

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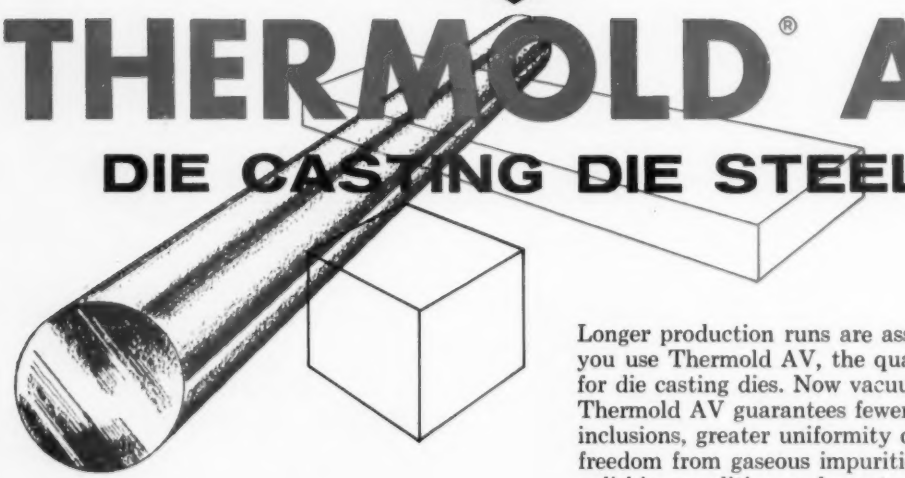

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The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.

Finishing Section

Anodic Oxidation of Aluminum Alloys

By R. E. PETTIT*

HISTORICALLY, the anodic oxidation process for aluminum and its alloys got started when Hans Christian Oersted announced before the Danish Royal Academy of Science in Copenhagen, "I have discovered the metal of clay." That was in 1825.

In 1827, the German physicist, Wohler, isolated aluminum in the form of a fine powder and produced lustrous pellets of the metal in 1845. The historical writings of this period tell us that, about 1852, Napoleon the third, nephew of the Great Napoleon, summoned and commanded Henri St. Claire Deauville, the great French chemist of his day, to develop an economical process for producing aluminum.

At that time, aluminum was priced at about $575.00 per pound. Deauville succeeded in bringing about some reduction in the price of aluminum, but even so the metal fell in the precious metal class.

A few years later, an investigator named Buff made the discovery that when an aluminum electrode and a platinum electrode were placed in a dilute sulphuric acid solution, there was a rapid diminishing of the initial high current surge when the aluminum electrode was the anode. This barrier effect was attributed by Buff to be caused by the presence of silicon. The then available aluminum contained a high silicon content.

Buff further learned that the barrier effect — that is, the falling off of the initial current value — took place only in sulphuric acid. In the presence of hydrochloric acid or chloride solutions, no such effect was observed.

Another investigator, Ducretal, in reviewing the work of Buff, attributed the barrier effect, or the falling off of the initial current surge, to the formation of aluminum oxide rather than silicon. Betz upheld Ducretal's view.

*TECHNICAL ADVISOR
INDUSTRIES DIV. THE DIVERSEY CORP.

Further study by Ducretal brought to light the phenomenon that, while the current fell rapidly when aluminum was anodic, the barrier effect was absent when aluminum was made cathodic. The current flowed freely, there was no barrier effect.

As the result of this work became known in the scientific world, much interest was created. This interest was directed toward the development of an aluminum cell as a rectifier for alternating current. Historically, the first commercial application for such a device was recorded in 1891 by Lablanc and Hutton.

Thus, the beginning of the anodic oxidization process for aluminum, as we know it today, gradually evolved from research work directed toward the development of the rectifying cell.

In the early 1920s, Messrs. Bengough and Stuart, English scientists, announced their work with the chromic acid electrolyte, pointing out the potentialities and the possibilities of the effective corrosion protection for aluminum and its alloys rendered by the developed oxide coating and a protective coating that could be colored with dyes. The work of these two English investigators further stimulated activity in the field of anodic oxidation, and intensive research was undertaken in widely-separated areas.

Over the previous years, research work on the rectifying cell had brought to light a number of solutions or electrolytes. It remained to again study these electrolytes and direct attention to the practical and economic appearance of the results. Of the number of electrolytes studied, only a few came through as economically and commercially practical. These are the sulphuric acid, the chromic acid and the oxalic acid solutions.

Of these three, the sulphuric acid method is possibly the most widely used bath and offers the greatest versatility. Unquestionably, the sulphuric acid method

continued on next page

predominates in the United States, whereas the chromic acid method and the oxalic acid process find considerable application in continental Europe.

In addition to the three electrolytes mentioned, there are two others of some commercial importance, but rather specialized in application. These are the phosphoric acid and the boric acid processes. The former is used as a preparatory treatment in the electroplating of metallic coatings on aluminum. The latter is used for the high di-electric value of the formed coating in certain areas of electrical work.

Considering the three major types of electrolytes, all have some solvent action upon the formed oxide film. Fortunately, the degree of attack is quite minute, and it is a function of concentration, temperature, and time.

THE SULPHURIC ACID BATH

In the operation of the sulphuric acid bath, the electrolyte undergoes no change at either anode or cathode, while the chromic acid electrolyte may be reduced at the cathode, remaining unchanged at the anode. Extensive changes take place in the oxalic acid bath – reduction at the cathode, oxidation at the anode.

Considering the sulphuric acid electrolyte, oxide coating formation appears to be a simple direct process of oxidation as described by Jenner, "Anodic Oxidation of Aluminum and its Alloys."

The discharge potential of the sulphate ion is given as positive 1.94 volts and that of the oxygen ion, positive 1.23 volts. In the electrolysis of the sulphuric acid electrolyte, the oxygen ion, which is ever-present, is discharged (because of its lower potential) before the sulphate ion.

Under these conditions, the nacent oxygen is liberated and extremely active. Because of the high degree of affinity between aluminum and oxygen, these two elements combine to form aluminum oxide, the protective and absorptive coating.

Since the sulphuric acid electrolyte and the chromic acid electrolyte are not oxidized by the liberated oxygen at the anode, the full quantity of this liberated oxygen is available for the formation of the aluminum oxide coating. Some oxygen is lost for this purpose in the oxalic acid process, due to the partial oxidation of the electrolyte.

During sulphuric acid anodic oxidation, the processing conditions or factors have an important part in the development of the oxide coating and its physical properties. Such variable factors as the applied current density, the electrolyte concentration, the temperature of the electrolyte, and the length of the processing cycle play their individual parts in the formation of the oxide coating.

Thus, the oxide coating may be hard or soft, it may be relatively thin or thick. Because of these differences, the oxide coating will exhibit varying degress of absorptive characteristics, resistance to abrasive and corrosive influences. Also, the basis metal, the aluminum alloy under treatment, is another factor affecting film properties, including the color of the developed aluminum oxide coating.

Essentially, the anodic film is aluminum oxide, a very hard substance. In such forms as corundum, for example, aluminum oxide is sometimes referred to as alumina. The hardness of such grinding material is well known. On the Moh's hardness scale, aluminum oxide is rated between 7 and 8, the diamond at 10.

As the concentration of the electrolyte, or its temperature, is increased, the abrasion resistance of the oxide coating diminishes. Conversely, as the electrolyte temperature decreases, or the concentration of the electrolyte is lowered, the formed oxide coating is more abrasion resistant, denser in structure, and less absorptive.

When speaking of coating hardness, hardness is considered in terms of abrasion resistance rather than the result of a blow or impact. The coating being very thin, resistance to impact is governed by the basis metal rather than by the thin oxide coating.

In the present state of the art, it is best to perform any forming operations before applying the anodic oxidation treatment. Any deflection of the anodically coated material can cause development of minute cracks or breaks in the oxide coating which are generally referred to as "crazing." Brittleness of the hard anodic film is responsible for development of these fine, minute coating breaks. These cracks, which are extremely fine, tend to close up when the metal is returned to its original form. Under this condition of deformation, the oxide does not flake off or lift, even with repeated bending.

Investigators have attempted to render the coating more pliable by applying various chemical treatments. Such treatments – use of a weakly alkaline solution, the alternating current treatment, and the addition of water glass to the electrolyte – are alleged to be of some value.

Raising the temperature or the concentration of the sulphuric acid electrolyte, as mentioned before, renders the film more flexible. However, this procedure should be approached with caution so as not to produce a soft, powdery coating.

ANODIC FILM RESISTS HEAT

The anodic film is resistant to heat. Aluminum oxide has a melting point of about 2000°C. On the other hand, the basis metal upon which the oxide coating is formed has a melting point in the general range of 650-660°C. The lower melting point basis metal aluminum, therefore, sets the limitation on heating.

When subjected to elevated temperatures, 300-400°F (approximately 150-205°C), minute hairline cracks will develop in the hard protective oxide coating. The thicker or heavier the coating, the more pronounced these hairline cracks. Expansion differences between metal and coating contribute to this condition of "crazing." Even though the temperature may be raised to the melting point of aluminum or of its alloys, the coating is not affected and does not scale, blister, or chip.

It has already been pointed out that the aluminum oxide coating formation is the result of direct oxidation, the combining of aluminum and oxygen. The coating is developed directly from the exposed aluminum surface reacting with the liberated oxygen.

If the anodic oxidation process is carried out properly, the bond, or the adherence, between the formed coating and the basis metal is good. In fact, it is very difficult to separate them by mechanical means. The oxide coating may be considered an integral part of the base metal, or intergrown with the basis metal during the anodic oxidation process.

In commercial operations, when necessary to remove the oxide film, this may be done by chemical means. Certain chemicals readily dissolve this oxide coating, but also continue their attack to the basis metal. Other chemical combinations are so designed as to remove only the oxide coating without attack upon the basis metal.

In contrast to the electroplating of metallic coatings, the oxide coating formation is from the "inside out." That is, the outer layer of the coating represents the first formed, while the last formed oxide coating is at the aluminum interface. In electroplating, the metallic deposit is built out by depositing metal upon previously deposited metal. In anodic coating work, the oxide film is "built in" by continually converting aluminum to aluminum oxide and pushing out the previously formed oxide.

Coating thickness is a formation of ampere minutes. A coating thickness of 0.4 mills (0.0004") is considered average for a 30 minute treatment as the art is practiced in industry. Heavier coatings are produced for special applications (as in the anodic hard coating processes) where coatings of 1 mil (0.001") may be developed in approximately 20 minutes.

ALUMINUM OXIDE COLORING

Aluminum oxide is a relatively colorless material. The electro-chemically formed oxide may be colored in some degree either from the presence of alloying metals or metallic impurities in the alloy. Another possible cause for the aluminum oxide coating assuming some degree of color may result from occlusions being picked up from the acid electrolyte during oxide formation. Also, the type of electrolyte will have some effect upon the color of the formed oxide coating.

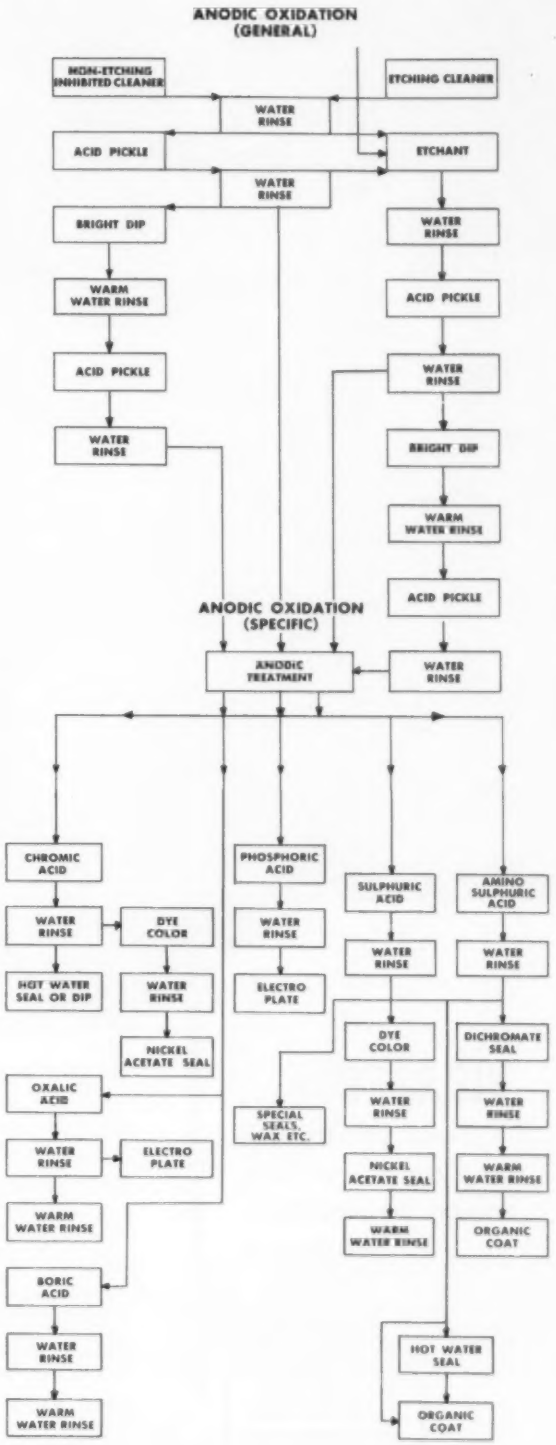
Because of the alloying constituents, different aluminum alloys will present differences in appearance, some minor, other considerable, upon anodic oxidation.

Silicon-bearing alloys take on a grayish appearance, the depth of color increasing with the silicon content. The color also is intensified as the thickness of the oxide film increases. A brown tint is sometimes observed with manganese-bearing alloys, while the copper-bearing alloys assume a yellowish tone.

A tenacious, dark-colored scale is formed during the heat treatment of the heat treatable aluminum alloys. Upon machining this type of alloy in specific areas and then anodically coating the part, a pronounced color variation is apparent between the machined and the unmachined surfaces. The former relatively clean or clear, the latter dark and possibly mottled. It is the heat treat scale that causes this dark discoloration.

Oxide film appearance may sometimes be influenced by the metal structure. There are times upon anodic treatment of various wrought or cast products that surface variations, sometimes and somewhat symmetrical in appearance and pattern, will appear.

continued on page 82



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Equally important, the Vibratron puts an end to manual handling of parts and media. A built-in, removable, double-decked vibrating separator separates parts and media, as well as fragments from the media in one simple operation. There's no need for an extra separator.

The Vibratron is simple in design. Uses standard, *tested* components which require minimum maintenance. Power requirements are low. Fixturing is easy because of the open tank design. Another advantage . . . noise level is at a low hum. The machine need not be bolted down.

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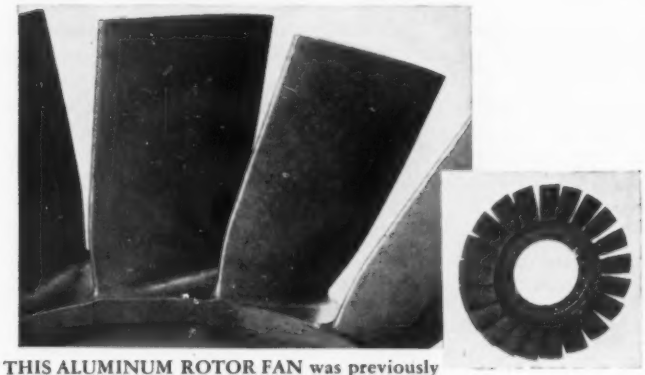
NOW THERE'S NO NEED FOR HAND FINISHING OPERATIONS ON PARTS LIKE THESE . . .

The above diagram shows how the Vibratron work zone extends throughout the abrasive mass. Every part is subject to a constant abrasive action.



THIS ALUMINUM ROTOR FAN was previously deburred, and *still* surface irregularities were not removed. IN THE VIBRATRON they are fixtured 10 parts per machine. Time cycle: one hour. No hand work required. Surface greatly improved.

Before Vibratron processing this aluminum sand casting (shown above) was hand deburred, then tumbled into a multiple compartment machine for 30 minutes. IN THE VIBRATRON it is processed 4 parts to a machine. Time cycle: 15 minutes. No hand operations required. Finish is far more uniform.

It took two belting operations *and* 20 hours of tumbling to blend in grinding lines on these forged shears, still parts were sometimes distorted during processing. THE VIBRATRON time cycle is 6 hours. No hand work required. No part distortion.

This complex business machine part previously required hand deburring because barrel finishing bent the parts. IN THE VIBRATRON 100 parts are completely deburred in a 30 minute cycle.

With the Vibratron . . . you can clean, descale, deburr, form radii, fine-finish and color stamped, cast, forged and machine parts, finish them faster . . . better . . . and more economically.

LET US PROVE IT TO YOU

Send a few unfinished parts to us . . . and a finished part to use as a guide. *We will process them for you and guarantee the same results in your plant as we get in our finishing laboratory.*

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Automatic Electrostatic Spray Painting

MODERN FINISHING systems are helping manufacturers produce more, improve quality, and keep prices down.

A good example is Interstate Precision Products Corp., Anaheim, Calif., which decided it needed an improved finishing system in order to assure a long-lasting, good looking, wrinkle finish on its vacuum cleaner, floor polisher, and carpet sweeper.

After extensive study, testing, and experimenting, Interstate switched from hand spray to automatic Ransburg No. 2 Process electrostatic spray painting. They installed an automatic unit of four single Ransburg atomizing heads on their finishing line.

Not only was paint quality improved, but electrospray is accounting for substantial savings in production costs and materials.

Here's how the system works:

Die cast aluminum housings and lids are suspended from a trolley conveyor and automatically cleaned, preheated, painted, and baked. They first pass through a vapor degreaser for cleaning, then go through a preheater just before they're painted.

In the electro-spray unit, four Ransburg single-head units paint the housings with wrinkle enamel. The operation itself is very clean, and there is no spray visible as the coating is done. Parts are rotated as they pass through the electrostatic spray painting area. Two heads (Ransburg atomizing bells) spray from opposite sides of the line.

After painting, the parts travel through an overhead, electric radiant oven for baking. Timers on heaters are used to hold part temperatures between 200 and 325°F for 15 minutes. Then, after baking, the parts are transferred from the finishing line to the assembly line.

The Ransburg unit, with a single operator, now handles the work formerly done by two hand sprayers. Furthermore, where rejects used to run as high as 10% with hand spray on the wrinkle finish, rejects now average less than 2%. And, where they used to get only 28 sets of parts per gallon of paint by hand spray, Interstate now gets 57 sets per gallon.

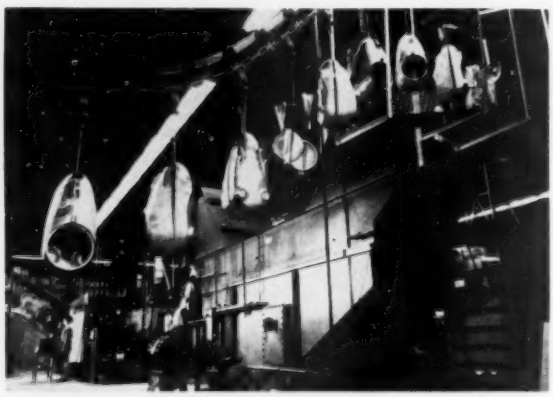

FIGURE 1. Overall view of the automatic operation.

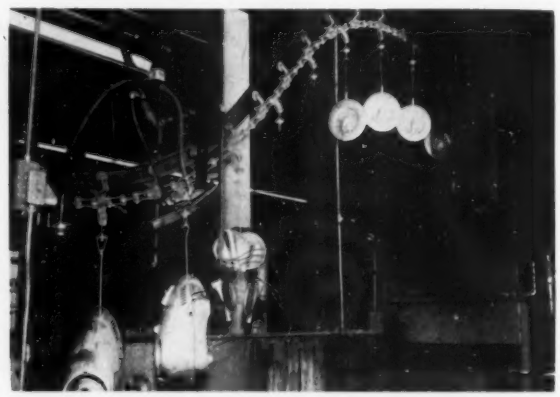

FIGURE 2. Aluminum die castings entering preheat.

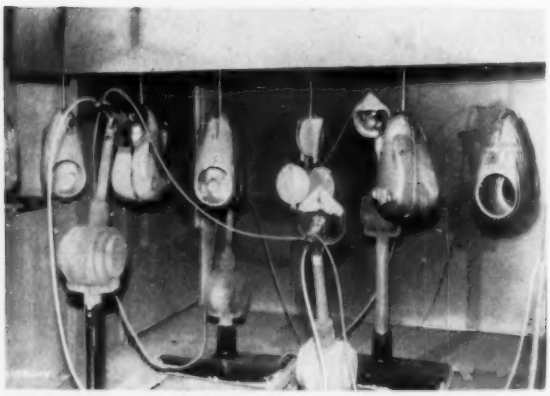

FIGURE 3. Ransburg units spraying die cast housings.

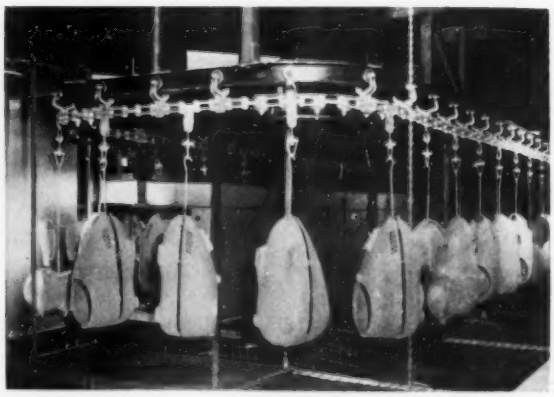

FIGURE 4. Baked parts emerging from radiant oven.

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ON ALUMINUM

An IRIDITE-IRILAC finish will provide longer life for storm doors, windows, outdoor furniture, auto parts and accessories, tubing or wire goods. And, you have a choice of color finishes such as natural aluminum and golden yellow. Other colors may be obtained by an additional dye operation.

ON MAGNESIUM

IRILAC over an IRIDITE No. 15 finish increases corrosion protection, and provides resistance to finger printing and abrasion on all types of products, with color appearance ranging from light to dark brown.

ON ZINC

IRIDITE plus IRILAC gives your product longer life and brighter appearance. Color choices range from clear IRIDITE to olive drab, plus colored dye finishes.

IRIDITE is the tradename for a specialized line of chromate conversion coatings that can be applied to any non-ferrous metal by brush, dip or spray methods—at room temperatures—manually or with automatic equipment. Upon application, a thin film forms which becomes an integral part of the metal itself, and thus cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel are required.

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For complete technical information on IRIDITE Chromate Conversion Coatings or IRILAC Clear Protective Coatings, write for FREE TECHNICAL MANUAL. Or, see the Allied Field Engineer in your area. He's listed under "Plating Supplies" in the yellow pages.

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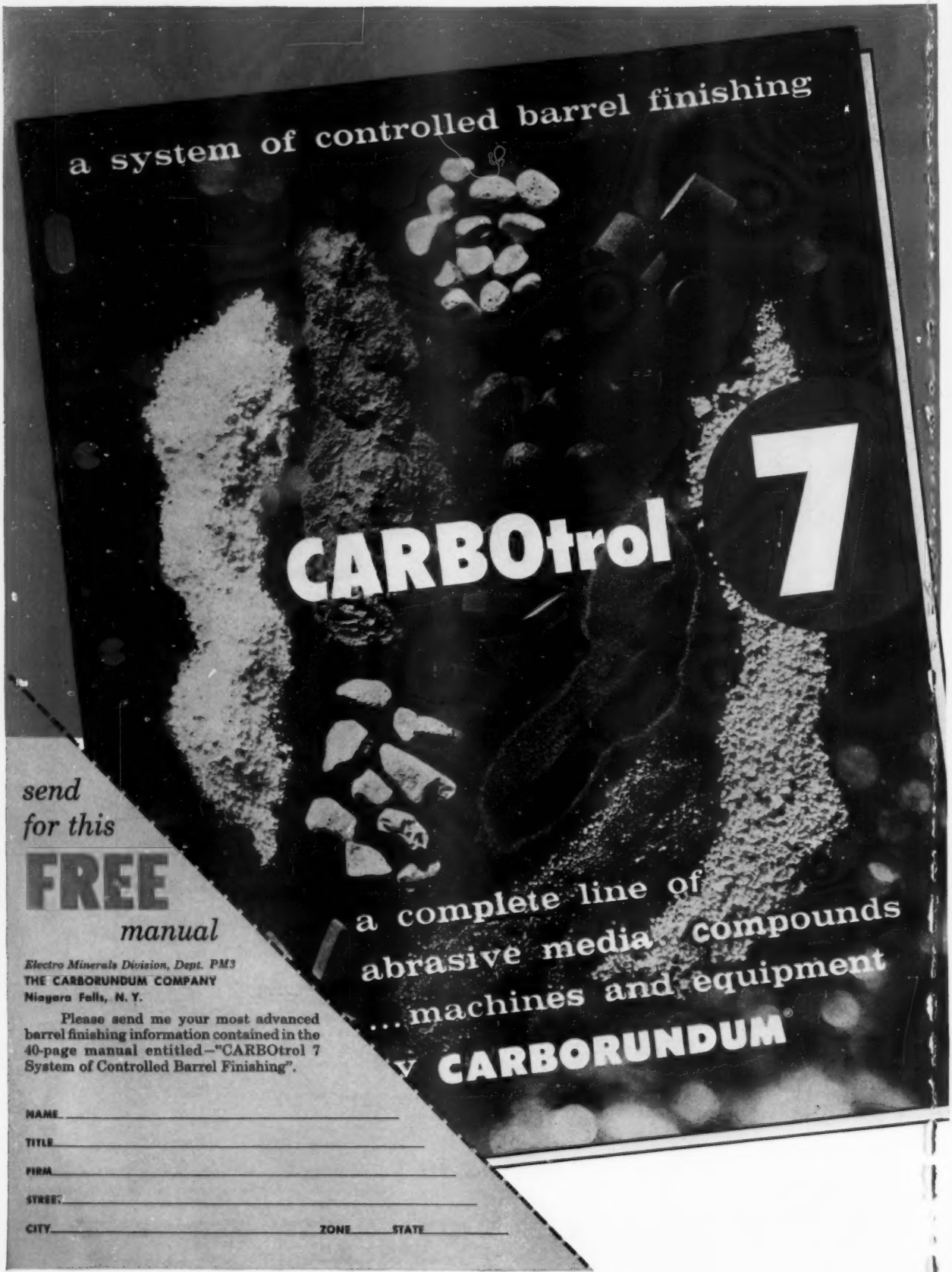
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ANODIC OXIDATION

continued from page 75

These patterns may be traced to metallic components in the alloy. These constituents may take on a geometrical pattern which is accentuated by the anodic treatment, possibly by certain surface treatments. Streaks, or other surface blemishes, caused by segregation at the grain boundaries and made apparent by the anodic treatment, may possibly be removed, at least minimized, by a suitable heat treatment.

Mechanical or selective chemical pretreatments may be used to alter the appearance of the oxide coating. Polishing, buffing, chemical etching, chemical brightening treatments, scratch brushing, and sandblasting all have a direct bearing upon the appearance of the anodic coating.

The first formed anodic coating is invisible when applied to a highly polished surface. As the coating thickness develops, after several minutes of processing, depending upon the current density, interference colors will develop. All the colors of a spectrum are seen as coating thickness increases until, when film thickness has grown to a certain value, these colors disappear. In commercial operations, individual parts upon completing the processing cycle have been known to show these inteference colors, generally the result of poor electrical contact during the anodic oxidation treatment.

Electrolytes used in anodic oxidation work have their influence upon the color of the formed coating. The chromic acid film is quite opaque and gray in color, while the oxalic acid film is of a light straw color, becoming more pronounced as film thickness is increased.

In a very moderate degree, the anodic oxide film is soluble in a sulphuric acid electrolyte. Some solubility of the coating is necessary for film formation. Solvent action, in a very moderate degree, enables pore cross section to allow the passage of the current leakage required to promote further film growth.

FILM POROSITY IMPORTANT

Film porosity is important. The commercial utility of the film is in some measure the reflection of this porosity. The absorptive power permits the impregnation of the oxide film with photosensitive materials, insulating materials, and dyestuffs. This advantage overshadows any disadvantages that may arise from film porosity. Because of this porosity, oxide films are valuable as a basis for organic coatings.

While porosity of the oxide film may have certain disadvantages, in relation to its protective value, this disadvantage may be overcome through corrective sealing of the pores of the oxide coating.

That aluminum oxide is an insulating material is well known. Under ideal conditions, an oxide coating of .4 mils (30 minute treatment) will withstand a line potential of 500-600 volts. Due to weak spots in the oxide coating, however, the breakdown voltage may be as low as 200 volts.

While the oxide is relatively resistant to the passage of an electrical current in the dry state, in the presence of the sulphuric acid electrolyte, current flows under a potential of 18-24 volts.

In contrast, the boric acid process may require a much heavier line potential. In some instances an applied voltage of 500 was not sufficient to cause any appreciable flow of current.

The sulphuric acid anodic processing line is made up of several components. Such components involve air supply for agitation of the anodic oxidation electrolyte; exhaust facilities for fumes from

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certain of the processing tanks; refrigeration facilities for cooling the sulphuric acid electrolyte; heating equipment for hot tanks such as cleaners, sealers, and dyes; a low voltage generator or rectifier of sufficient capacity to handle the determined work load; and a series of tanks, including the anodic processing tank, the cleaning tanks, water rinse tanks, sealing tanks, and dye color tanks.

IMPORTANT CONSIDERATIONS

It is important to give full attention to the space to be occupied by this equipment. Where a plating line exists, anodic equipment is often grouped with the plating equipment. Again, the anodic equipment may be located because of the desirability of tying it in with other manufacturing operations to assure a uniform flow of work. The capacity of the equipment with reference to size of work load must be carefully considered. This, in turn, will indicate the required floor space.

Other considerations which may affect the location of the equipment are acidproof flooring, drainage facilities, availability of steam, air, and water, electrical power lines, and fume exhausting equipment conforming to local ordinance and zoning requirements.

The mechanical refrigeration unit, if one is to be used, and the rectifier or the motor generator set for supplying current to the anodic tank, should be in a separate room to avoid fume exposure, yet near the anodic processing tank.

Iron tanks should never be placed directly on the floor, as severe corrosion may occur. It is advisable to rest all tanks on chimes, wood or acidproof cement, possibly 4 inches by 4 inches running at right angles to the length of the tank. By raising the tanks in this manner, air circulation is assured and proper maintenance is more readily accomplished. Before setting tanks it is good practice to apply a generous coat of an asphaltum base paint to the bottoms of the tanks. Duck boards are used in some installations in all areas around the tanks.

The number of tanks, and the size of the tanks, will vary depending upon the finish to be produced, plain or colored work, dichromate

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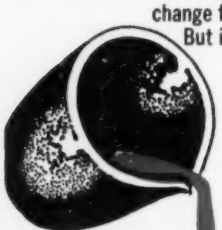

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sealed, or a combination of these finishes. Also, the size or volume of the work to be processed will affect tank size. Uniform tank size throughout the entire installation is found in some lines, other lines do not require the cleaner tank, rinse tanks, dry or sealing tanks to be of the same size as the anodic processing tank.

Good, uniform oxide coatings require efficient and thorough cleaning. Cleaning procedures will vary with the degree of soil, the kind of soil, and the ultimate finish that is desired. For example, use the inhibited cleaner for buffed work, the etching cleaner for the matte or etched finish, or combinations.

Alkaline cleaning tanks may be constructed of iron boiler plate with welded seams. Such tanks should be fitted with a drain, an iron pipe steam coil, or other means of heating the cleaning solution. They should be of sufficient area or capacity to maintain the solution temperature at the highest required working level.

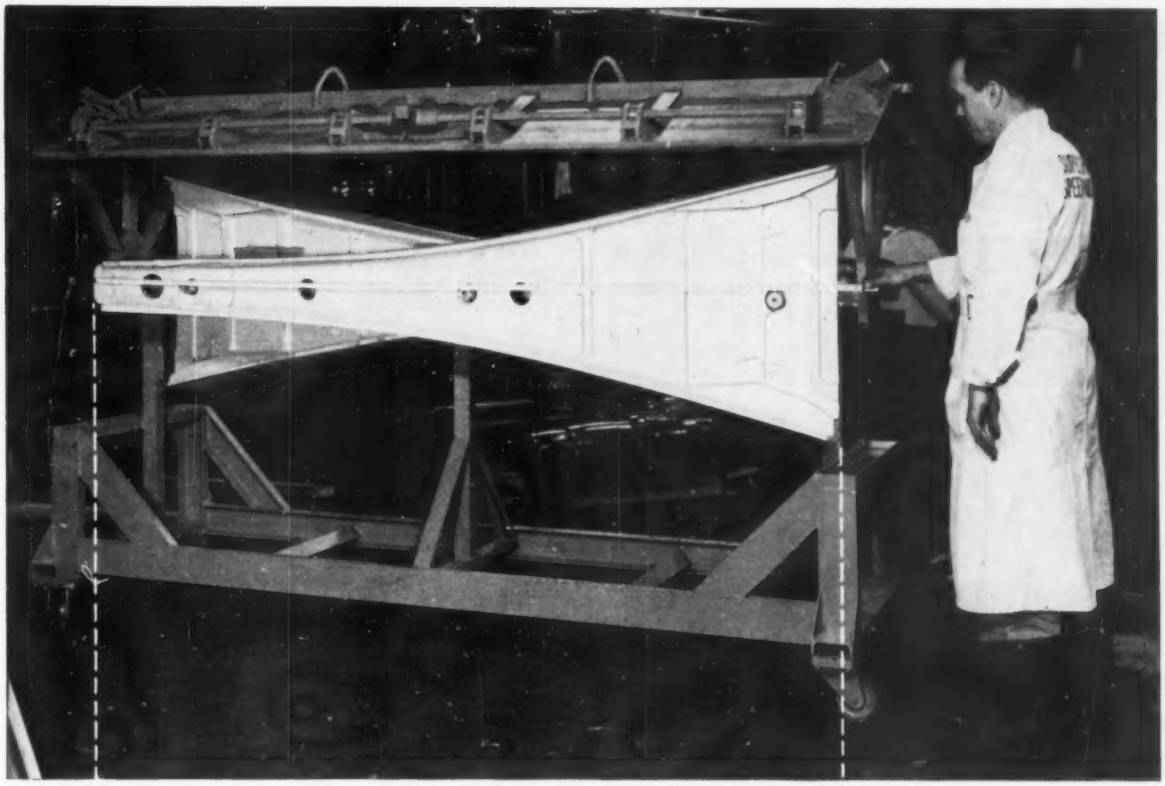
WATER SUPPLY LINE HELPFUL

A water supply line, especially for the larger installations, is helpful where frequent water additions are necessary to compensate for evaporation losses. Adequate exhaust facilities are most advisable for the etching type of cleaner.

The importance of good rinsing facilities cannot be stressed too highly. The difference between good work and rejected work is often the difference between good and poor rinsing. A rinse tank, or spray rinsing facilities, should follow each processing treatment. The nature of the installation will govern the number and the type of rinsing stations.

Rinse tanks are generally constructed of boiler plate with welded seams, fitted with an overflow dam, a drain, and a water supply line. For the continuous water flow, the incoming water is best introduced at the bottom of the tank by means of an iron pipe. The overflow dam is located at the opposite end of the tank from the incoming water.

Double rinse or compartmented tanks may be used. Here, the water flows over the dividing partition from the second to the first



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These aircraft wing spars are barrel finished to blend in radii and improve micro-inch finish on other surfaces through use of ALMCO Supersheen media and burnishing compounds. All surfaces receive the same treatment—rejects due to imperfect finishing are eliminated. Tremendous labor savings are made by using ALMCO's modern barrel finishing methods.

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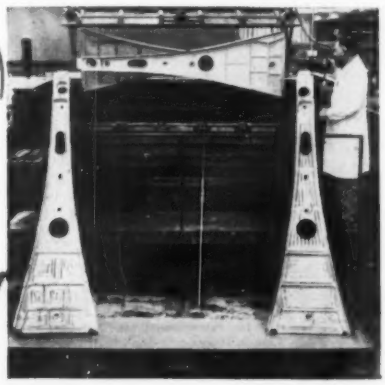
Note "machining ridges" on foreground spars, prior to Almco Barrel Finishing. Supersheen Aluminum Oxide chips with Almco #10 compound are used in 2 hour finishing cycle.



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ANODIC OXIDATION *continued*

compartment. In this way, the second compartment provides clean water at all times. Each compartment should have a drain, and the second compartment is equipped with the overflow.

The actual anodic oxidation is done in the sulphuric acid electrolyte, with the solution generally contained in a lead-lined tank, either steel or wood. The work is made the anode or positive terminal, the tank lining cathodic or negative. The lining may be #8 antimonial or tellurium sheet lead with burnt seams, not soldered. All service lines to the anodic tank should be insulated from it by means of rubber hose coupling or an insulated coupling.

Other construction materials, such as rubber-lined steel, acid-proof brick, glass, or korolac-lined steel may be used. Stainless steel tanks have been reported satisfactory, employing such stainless steels as Carpenter #20 or #316. Where non-metallic or non-conducting materials are used as the tank or the tank liner, auxiliary metallic cathodes are hung in the acid electrolyte to conduct the applied electrical current.

EXHAUST DUCTS NEEDED

Exhaust ducts to remove spray or processing fumes should be provided. These may be of steel, reinforced lead, wood (Gulf cypress), or masonite. They should be protected on the inside with an asphaltum paint. Air agitation is used to maintain a general movement of the electrolyte to increase the efficiency of the cooling, or removal of the generated heat.

To prevent electrical shorts between work and metallic tank lining, a wooden open-work lattice or a plastic lattice is installed to protect the lining, yet permit free circulation of the electrolyte. Cypress, beech, or maple may be used. Oak is not satisfactory. A drain plug in the anodic processing tank is advisable.

A small steam coil in the anodic processing tank is recommended, since there may be times when it becomes necessary to raise the temperature of the electrolyte before starting production, particularly

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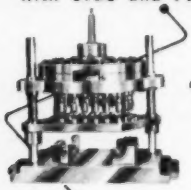

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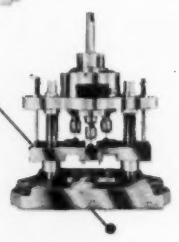

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Use Prep Products for better results—better quality, low operating cost—low maintenance cost—the complete line for every purpose in your pre-painting program. We supply the complete "package" along with the technical know-how and experience to fit your particular needs. Tell us your problem—Let us make recommendations—Write today.

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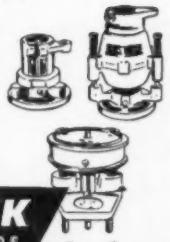
LET'S PUT OUR MULTIPLE HEADS TOGETHER!

. . . and plan your small hole drilling & tapping operation on a low cost, maximum production basis

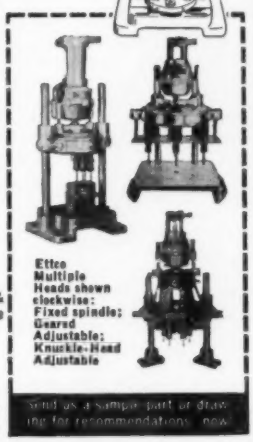


ETTCO-EMRICK
MULTIPLE SPINDLE HEADS

UNIT-ENGINEERED *for drilling or tapping on any drill press*

No one type will do for every job. That's why we make 'em all—and the correct custom tooling for faster handling of the parts. The Ettco system is a completely integrated service: not just multiple heads with spindles reaching into the air!

Ettco engineers can tell you without obligation which type best suits your specific job. They're all easily attachable to your present drill press, tapping machine or automated special. Standardized, reuseable components mean lowered costs. Interchangeable face plates permit quick switch from tapping to drilling. Write for catalog.



Ettco Multiple Heads shown clockwise: Fixed spindle; Geared Adjustable; Knuckle-Head Adjustable

Send us a sample part or drawing for recommendations now.

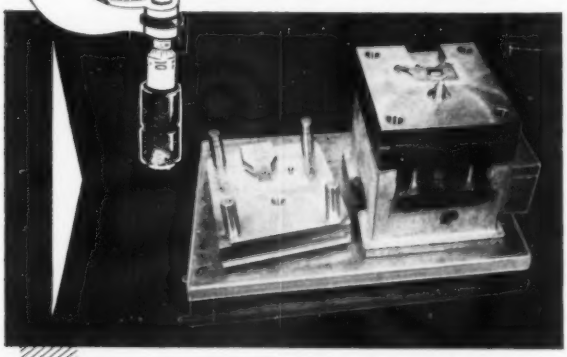
Ettco-Emrick

The only complete line manufacturer of drilling & tapping equipment for the entire small hole field

See your authorized Ettco distributor

ETTCO TOOL & MACHINE CO., INC.
586 Johnson Avenue, Brooklyn 37, N.Y.

PRECISION DIE CASTING DIES FOR ALL MACHINES



A new modern well-equipped plant that was designed and built from the foundation up to manufacture plastic molds and die casting dies exclusively is ready to go to work for you. Damen offers you complete engineering facilities and manufacture capabilities to build your plastic molds and die casting dies. Loading and crane capacities to handle dies and molds that weigh up to five ton. All requests for quotations get prompt and immediate attention.

- **KELLERING**
- **TURCHAN DUPLICATING**
- **JIG BORING**

Send for up-to-date brochure.

DAMEN TOOL & Engineering Co. Inc.
4621-27 N. Olcott Ave.
Chicago 31, Illinois
Phone: UNderhill 7-8111

Circle No. 25 on Reader Service Card

Spirals to lower costs Die Cast by LITEMETAL

The spiraled overhead-door cable drums shown here are worthy examples of the advance techniques developed and used by LITEMETAL for economically and efficiently meeting customer specifications.

You will note that these cable drums feature cast-in spiral grooves, anchor points and key-ways. The larger drum especially features a high lift area of increasing radius, along with cast-to-size shaft holes and key-ways. Machining costs are virtually eliminated as these products require only inexpensive drilling and tapping for set screws.

LITEMETAL DICAST, Inc., one of the few active producers of aluminum, magnesium and zinc die castings, is an organization of specialists—men thoroughly experienced in the casting and machining of these alloys.

Additional facilities offered by LITEMETAL include plating and finishing to hardware standards through affiliated sources, placing at your disposal an integrated time-saving service, coupled with LITEMETAL skill and efficiency.

These symbols are important to you! To better serve our customers, LITEMETAL, through active participation with other die casters in various committees of the American Die Casting Institute, is constantly kept informed of the latest techniques, materials and equipment that are advantageous to the die casting process.

DIE CASTING RESEARCH FOUNDATION PARTICIPANT

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST Inc.
A SUBSIDIARY OF HAYES INDUSTRIES
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PLANT AND EXECUTIVE OFFICES

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A simple, painless examination, the "Pap smear", helps physicians detect cancers of the uterus *in time*. When discovered early and properly treated, this second most common cancer in women is nearly 100% curable.

Our film, "Time and Two Women" will show you how to guard yourself against uterine cancer. It has already saved many lives. To see it, call the office of the American Cancer Society nearest you, or write to "Cancer", c/o your local post office.

AMERICAN CANCER SOCIETY

during the winter months and over a cold weekend.

SEALING PROCEDURES

In the anodic process there are three general sealing procedures:

- Hot water sealing for plain work.
- Nickel acetate sealing for colored work.
- The potassium dichromate sealing procedure for maximum corrosion protection.

The hot water seal tank may be of wood, stainless steel, or stainless steel-lined steel. It should be large enough to accommodate the entire load. A drain and heating coil of stainless steel should be provided. The heating coil should be large enough to permit heating to the operating temperature of 208-212°F with the available steam pressure. An overflow dam to permit periodic skimming of the solution's surface is advisable, as well as a water supply line. If desired, the hot water sealing tank, as well as other hot tanks, may be heated with electric immersion heaters or with an immersion gas burner.

The nickel acetate sealing tank is similar in construction to the hot water sealing tank, and the operating temperature of this solution is 208-212°F.

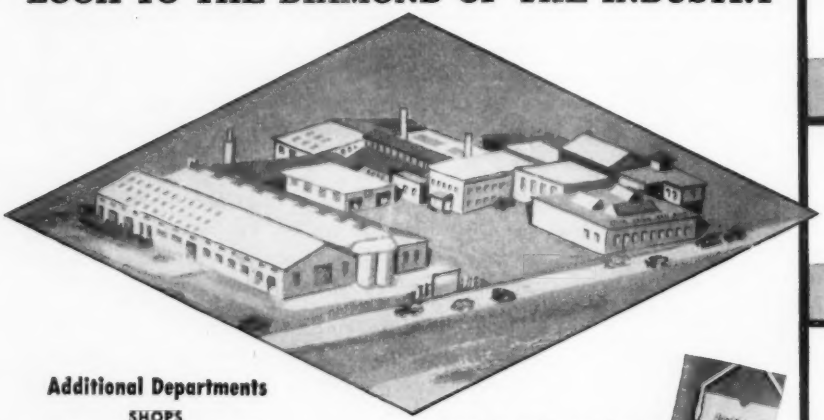
THE DICHROMATE SEALING TANK

For the dichromate sealing tank, a plain welded boiler plate tank is satisfactory. Like the water seal and the nickel acetate sealing tank, this tank should be equipped with heating coils for an operating temperature of 208-212°F, a drain, an overflow dam for periodic skimming, and a water supply line. It is recommended that this tank be equipped with an exhaust duct. This should be checked with local authorities concerning rules and regulations for exhausting a hot potassium dichromate solution.

THE COLORING TANK

Stainless steel or stainless steel-lined iron or boiler plate may be used for the dye or coloring tanks, which are similar in construction

For Guaranteed Quality
LOOK TO THE DIAMOND OF THE INDUSTRY

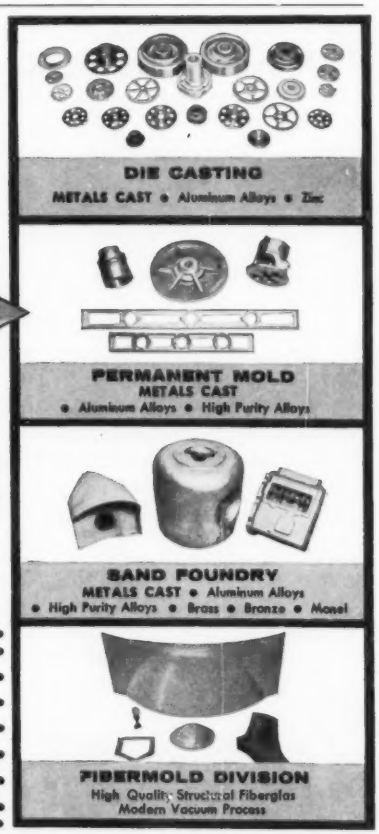


Additional Departments

SHOPS
• *Pattern* • *Machine* • *Die*

FACILITIES
• *X-Ray* • *Laboratory*
• *Heat Treat* • *Wheelabrator*

Send for the brochure "Behind the Scenes" . . . complete digest of Hampden Brass's experience, Equipment and Facilities


DIE CASTING
METALS CAST • Aluminum Alloys • Zinc
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Established 1903
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DIE CASTING MACHINES

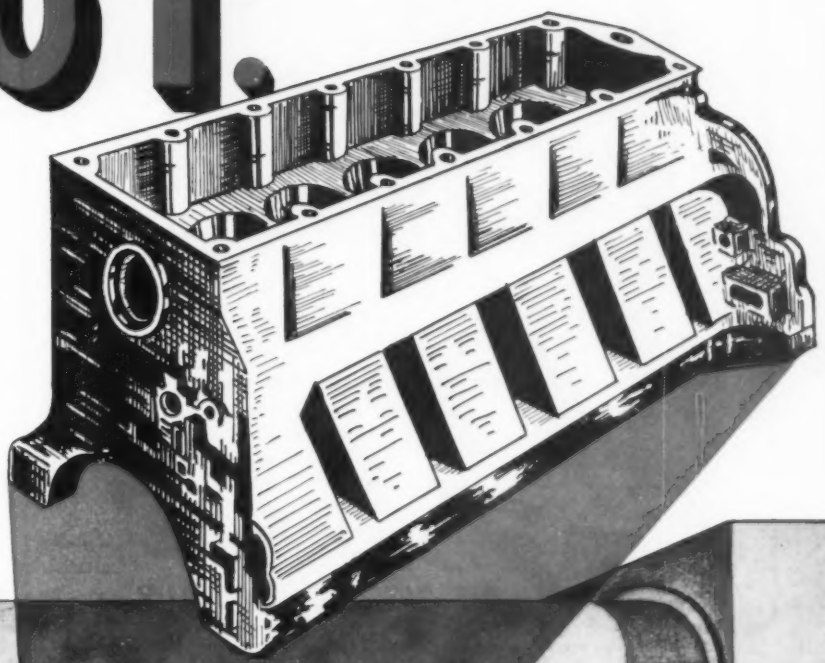
clamping force:

2500 T.

hydro-mechanical clamping

LARGE PLATENS

BIG ROOM



CHARACTERISTICS			
Clamping force		(Short Tons)	2500
Max. room between open platens		in.	100
Stroke of moving platen		in.	60
Thickness of die	max.	in.	60
	min.	in.	40
Useful size between platens		in.	78
Useful size between tie bars (vertical)		in.	52
Injection capacity (based on Al.)		up to 100 lbs.	
Specific pressure on the material		up to 28200 lbs/sq. in.	

TRIULZI

NOVATE (MILANO) ITALY

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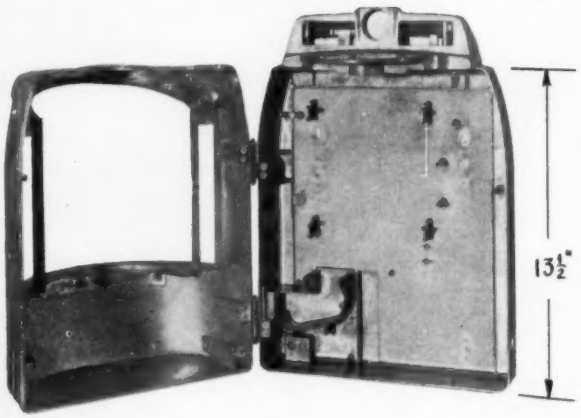

Die Castings with various shapes and intricacies are truly "born to shape" with each casting. In Aluminum and Zinc and with our die casting engineered machines and tooling this science is available to you.

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DIE CASTING COMPANY
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Phone AIR-6-4823

ANODIC OXIDATION *continued*

to the tanks for nickel acetate or hot water sealer.

In general, the current density employed in the anodic oxidation process is around 12-13 amperes per square foot of surface. The direct current for the operation is supplied by a motor generator set or a rectifier. Such units are of low voltage, generally 18 or 24 volts. For all practical purposes, a coating 0.0004" thick is produced from a 15% sulphuric acid solution in a 30 minute treatment time with a current density of 12 amperes per square foot, the temperature of the electrolyte being 70°F.

In the hard coating processes, current densities reach as high as 36 amperes per square foot, with the line potentials ranging from 18-40 volts. These hard coating processes are specialized and are applied particularly for their resistance to abrasion. Such coatings do not take color and are not generally considered in the decorative class of work.

Heating of the several hot tanks may be done with steam, gas, or

continued on page 92

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Announcing . . .

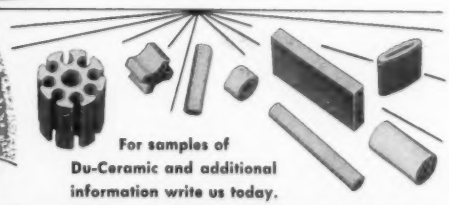
DU-CERAMIC

A special new material for investment casting cores

Big news in the ceramic industry is the development of a brand new material, Du-Ceramic, for investment casting production. Du-Ceramic has been designed expressly for achieving accuracy in precision molds. Shapes can be produced to close dimensional tolerances.

DU-CO steatite and technical ceramics

Cores made of Du-Ceramic require no drilling and other costly machining operations. The material is readily removed from the casting by leaching, using a concentrated sodium hydroxide solution.



For samples of Du-Ceramic and additional information write us today.

DU-CO CERAMIC CO.
SAXONBURG, PENNSYLVANIA

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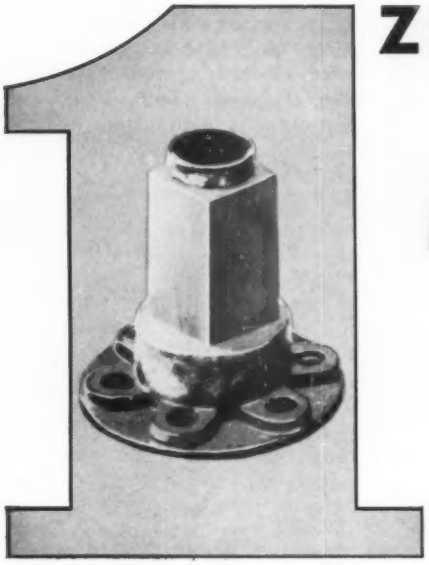
ZINC DIE CASTING



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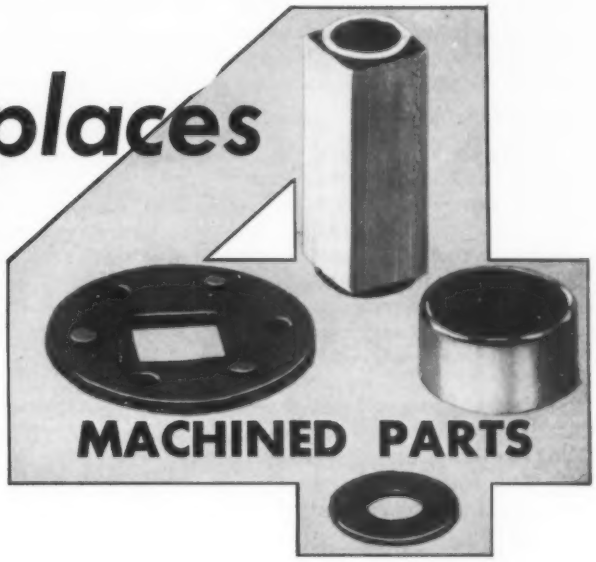

- *Eliminates Assembly*
- *Reduces Labor And Material Costs 50%*

This hub is part of the mechanism of coin-operated machines. Switching from brass and steel to a zinc die casting *slashed material and labor costs over 50%* for Chicago Coin Machine Division of Chicago Dynamic Industries.

Prior to the change, the 4-piece hub required 8 separate machining and assembly steps. The die casting however requires only 2; the casting is trimmed and the three assembly holes tapped. Scrap loss has been virtually eliminated, internal structural strength is fully retained.

The part is cast at a rate of 200 per hour in a 4-cavity mold and critical dimensions are held *as cast* to .005" overall, .003" concentricity. With annual hub requirements at 200,000, Chicago Coin Machine Division has found zinc die castings the way to meet today's rising production costs.

DIE CASTING is the Process

ZINC, the metal

BUNKER HILL

EASTERN SALES AGENTS
ST. JOSEPH LEAD COMPANY, 250 PARK AVENUE, NEW YORK 17

BUNKER HILL 99.99+% ZINC

SALES OFFICE FOR PACIFIC COAST
THE BUNKER HILL CO., 660 MARKET ST., SAN FRANCISCO, CALIF.

electricity. The method of heating is not important, just so long as the heating capacity is sufficient to provide the proper operating temperature for the solution volume.

GENERATION OF HEAT

During the formation of the aluminum oxide coating considerable heat is generated. It is important that this generated heat be dissipated or removed from the surface of the aluminum under treatment in order to prevent the formation of soft, smudgy anodic coatings. The sulphuric acid electrolyte may be cooled by circulating cold water through heating coils emerged in the processing tank. In some localities the circulation of tap water or city supply water may be used if an adequate supply is available at a temperature of 50°F during hot summer months. In other installations, mechanical refrigeration is the most efficient method of cooling and should be considered for large, heavy load operations.

For rapid calculations, the BTU's generated during the anodic oxidation process may be determined by multiplying the surface area of work in process in square feet by the amperes per square foot and the voltage rating of the power plant. This figure, multiplied by 3.411, will give the BTU's generated per hour. This 3.411 factor is generous and allows for atmospheric heat absorption with a temperature in the middle 90s.

Assuming a 22°F. temperature differential (the temperature difference between the incoming cooling water and the operating temperature of the electrolyte), approximately 19.8 feet of 1 inch O.D., ⅛-inch-wall lead tubing would be required for every kilowatt-hour of electrical input.

PARTS CAN BE PROCESSED MANUALLY, AUTOMATICALLY

The anodic oxidation process may be carried out on full automatic plating machines, still tank or manual operation, or strip lines.

Where parts are to be processed in a manual line, or on an automatic, they are racked or attached to a suitable fixture. The racked parts are suspended from the positively-charged work rod into the acid electrolyte, thus completing the electrical circuit. Racks consist of an aluminum spine to which are attached high-strength sheet aluminum clips which, by tension, hold the parts to be treated. Good electrical contact between parts and rack, as well as rack to work rod, is important.

Since the aluminum oxide coating is a di-electric, it is advisable to remove the formed oxide coating from the rack fingers after each operation in order to insure full passage of the applied current. Recently, rack tips of titanium were introduced, and their use eliminates the periodic stripping of the aluminum rack.

Anodic oxidation work is not difficult nor complicated. It is required, however, that adequate understanding of the process be obtained, that reasonable control of all processing solutions be maintained, and equipment kept in good working condition. If good work is expected, control, cleanliness, and good equipment are very important factors.

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CONTROLLED ALUMINUM DIE CASTING PRODUCTION
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Inquiries Invited.
321 SOUTH THIRD ST.
LAFAYETTE, INDIANA

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PRECISION METAL MOLDING

NEW PRODUCTS

continued from page 14

ELECTRONIC MACHINING

ELOX CORP. OF MICHIGAN — A new series of electrical discharge machine tools has been announced for producing extrusion dies, powdered metal dies, three dimensional cavities, etc. at a 25% to 50% savings over mechanical methods. Features include: Electrical mechanical power feed or hydraulic power feed; work table surface of 7″ x 17″ or 12″ x 18″; a 3¾″ dia. quill that travels 10″ vertically. The series can use any Elox vacuum tube or RC power supplies.

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3-HP VIBRATOR

LORD CHEMICAL CO. — The Model 1016E vibrator for precision finishing metal parts has a bowl capacity of 1.1 cu ft. This 3-HP unit, as others in the line, is said to work from 10 to 100 times faster than tumbling barrels, and more economically. The unit will do both coarse and precision work.

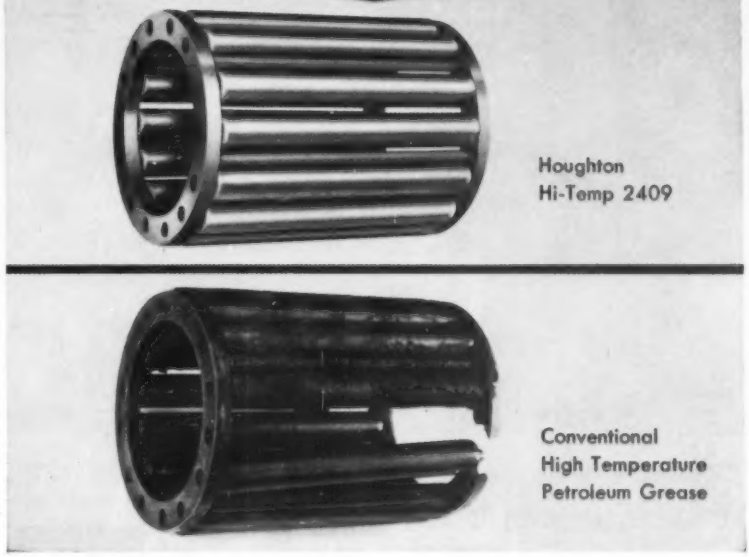
Circle No. 239 on Reader Service Card

COMPENSATES BUFFING WHEEL WEAR

MURRAY-WAY CORP. — An accessory has been introduced that accurately compensates for polishing and buffing wheel wear. The unit eliminates manually adjusting individual heads. All the operator has to do is push an electrical jog button which lowers the wheel a pre-determined distance.

Circle No. 240 on Reader Service Card

NOW! 1000°F. Lubrication with New Hi-Temp 2409



Bearing failure due to caking of carbon, de-composed thickeners, gums and resins at high temperatures can be prevented by use of Houghton's new Hi-Temp 2409 grease!

Hi-Temp 2409 represents a completely new concept in high temperature lubrication. In this new grease, *the thickener provides the lubrication—not the fluid!* No silicones, diesters, soaps, heavy metals or solvents are used.

A clean-burning synthetic fluid is used as a carrier. The grease becomes fluid at 200°F. carrying the lubricant to all bearing surfaces. At 500°F. the synthetic carrier is completely evaporated and a soft film of dry lubricant remains on the bearing capable of withstanding temperatures well above 1000°F.!

If you have a high temperature lubrication problem, it will pay you to investigate this new grease—Hi-Temp 2409. Call your Houghton Man for a demonstration or write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa., for your copy of Houghton's new booklet on "Thermal Lubrication".

HIGH TEMPERATURE LUBRICANTS

HI-TEMP 2409 GREASE
HI-TEMP 100, 200, 300 SERIES OILS
COSMOLUBE 101 and 102
HOT FORGING AGENTS
DIE CASTING LUBRICANTS
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Ready to give you on-the-job service

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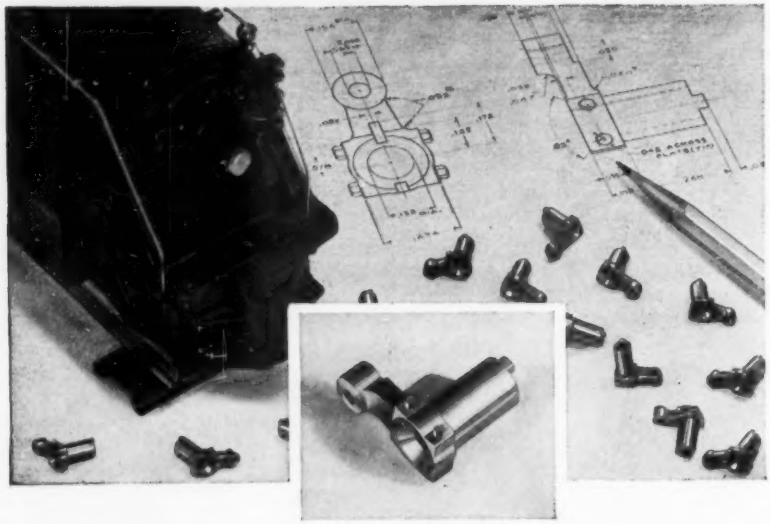
GRC DIE CASTING HELPS LIONEL ACHIEVE TINY PART AUTHENTICITY



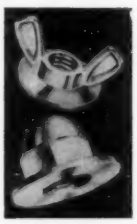
Tiny, intricate, too costly to make in their own plant, GRC's specialized techniques made this Toy Crank economically possible

While it would seem more advantageous for manufacturers to make all parts in their own plants, some have found that a specialist can do it cheaper, faster, and sometimes even better. This Lionel toy crank is an example. GRC specialized techniques made it possible for them to produce this tiny authentic part more quickly and more economically than Lionel could themselves. Die cast in zinc alloy in a single automatic operation, the cost of the GRC crank was little more than $5.00 per thousand in lots of 500,000.

Miniature in size, intricate in shape, this crank is typical of the many small parts problems economically solved by GRC. It is typical too of the close tolerances and uniformity achieved by Gries' fully automatic methods. Whether simple or complex, quality is high — no secondary operations, no scrap loss. GRC parts leave the machines ready for immediate use.

If you have a small parts problem, need flexibility in design, write for Gries' informative bulletins on **Zinc Alloy Die Castings and Injection Molded Plastics**, or send prints for quotations. There is no minimum size. Maximum: 1¾" long, ½ oz. in zinc alloy; 1¼" long, .03 oz. in plastic.

Washer base wing and cap nuts in die cast zinc alloy now cataloged by GRC



Save inventory, assembly time, and labor, with these wide-diameter washer base nuts. Eliminate separate washers. GRC offers prompt delivery from stock in a complete range of 14 thread sizes: #6 through ⅜". Specially suited for oversize bolt holes, adjusting slots, soft surfaces.

GRC nylon nuts and screws, wire ties and clamps, now available from stock

New nylon hex nuts in ten sizes (#2 thru 5/16"). Coil bobbins in a wide range of shapes and sizes — from ¼" diam. x ¼" long to ⅞" diam. x ⅞" long — in round, square, rectangular and oval shapes. GRC's specialized techniques help you take advantage of nylon's unique properties.

Yours for the asking —GRC HANDY GUIDE TO LOW COST QUALITY FASTENERS

WORLD'S FOREMOST PRODUCER OF SMALL DIE CASTINGS

GRIES

GRIES REPRODUCER CORP.

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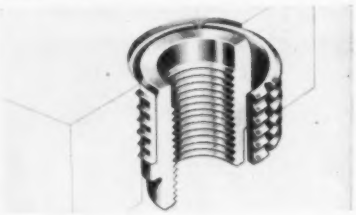
NEW PRODUCTS *continued*

INSERT SAVES TIME



HI-SHEAR RIVET TOOL CO. — The S110 insert is unlike other inserts in that it does not require counterboring and tapping. It only requires hole drilling. It is said to provide load bearing, wear resistant, self-locking threads for holes in cast aluminum, magnesium, cast iron, etc. The insert can be used in temperatures to 450°F. and meets self-locking & fatigue test standards.

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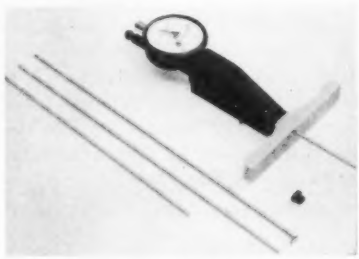
SIMPLIFIES GROOVE LOCATION



MUELLER GAGES CO. — The Mueller Depth Gage is a double-acting gage for the accurate determination of the location of either internal or external grooves. In addition it will measure tapers, with a special attachment. By adding a measuring ball it becomes a Pin Gage. The unit features speed and simplicity of setting for a wide variety of ordinary and difficult groove measurements.

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SOCKET CAP SCREWS

SET SCREW & MFG. CO. — A line of cold forged stainless steel socket cap screws has been announced with these features: Extra strength; Will take greater tightening torques, Clean chip-free sockets, Rolled threads for perfect fit. They come in the new A.S.A. 60 series.

Circle No. 243 on Reader Service Card

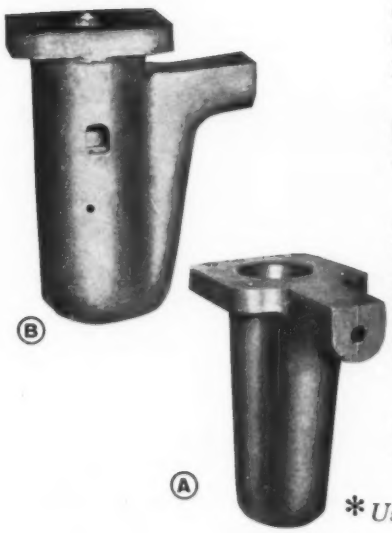
We make them all!

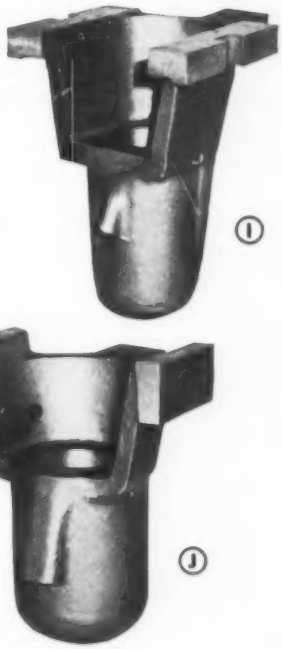
Now, *from stock*, you can obtain longer-lasting *steel* goosenecks* in nominal sleeve sizes for your die casting machines. Dodge goosenecks are machined and sleeved, ready for your use.

Shown here are just a few of the hundreds of Dodge *cast steel goosenecks* we have supplied to industry.

Select the one that fits your machine—then ask us for an eye-opening quotation! If your gooseneck isn't pictured here, ask. Chances are we've made it and it's available. Cast steel replacement parts, from pots to skimmers, are in stock, too.

Write us *today*. We'll be happy to furnish complete details, without obligation.





* *Users report better than 4-year service life!*

DS DODGE PRODUCTS

DODGE STEEL COMPANY

DODGE PRODUCTS DIVISION

6501 State Road • Philadelphia 35, Pa.

Phone: DEvonshire 2-2200

THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

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Circle No. 55 on Reader Service Card

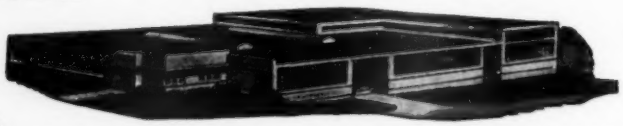
You can benefit by Milwaukee's 50 Years' Service to Industry

50th ANNIVERSARY
1909-1959

Since 1909, it has been the privilege of the Milwaukee Die Casting Company to work with manufacturers of a wide variety of products ... from mechanical pencils to airplanes ... in applying the die casting process to their problems of parts design and production. In those 50 years, Milwaukee has pioneered many of the developments which have since become standard practice.

If you wish to benefit by our 50 years of continuous service to industry coupled with the advantages of our modern die casting plant, we invite your inquiries.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

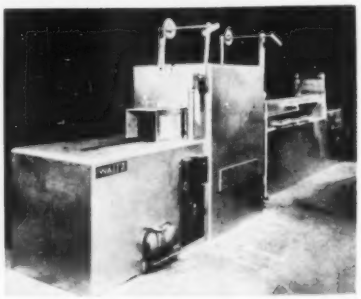


MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909

AS-9701

NEW PRODUCTS *continued*

SINTERING FURNACE



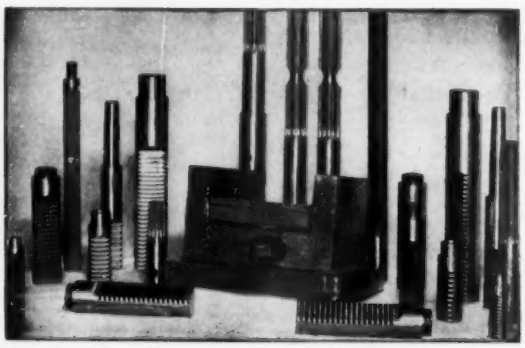
WALTZ FURNACE CO. — This 14-foot continuous sintering furnace features gas curtains to provide a protective atmosphere for the entire length of the heating and cooling chambers. The heating chamber is 12″ x 8″ x 48″ and is heated to a maximum temperature of 2300°F. by 8 vertically mounted glo-bars.

Circle No. 244 on Reader Service Card

POWER SUPPLIES

HEVI-DUTY ELECTRIC CO. — A complete range of AC and DC industrial power supplies for regulating voltage, current, or power for in-

PEERLESS
"FLAME-A-LOY"® PINIONS and RACKS
FOR DIE CASTING & PERMANENT MOLDS



Standardized To Mate and Interchange With Each Other For Longer Wear At Less Cost.

—We Welcome Your Inquiries—

PEERLESS GEAR & MACHINE CO.

140 E. WAYNE STREET
DUNKIRK, OHIO
TEL. 3101

Precision Products Since 1921

*Trademark Registered

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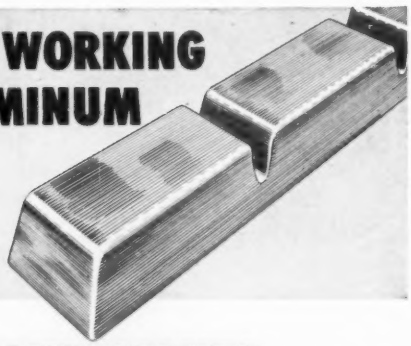
FOR WORKING ALUMINUM



FISKE LUBRICANTS are especially formulated for working aluminum and aluminum alloys. They will enable you to produce clean aluminum products at lower cost.

Machining	C.S.A. No. 2 Cutting Oil
Rolling	Majestic Soluble Oil
Die Casting	231 Die Casting Compound
Extruding	514A Hot Die Lubricant
Stamping	Magic Compound
Forming	Magic Compound
Wire Drawing	Magic Compound

Let us know how you work aluminum and we will send you the bulletin that describes the Fiske Lubricant made for your industry.

FISKE'S Since 1870 METAL WORKING LUBRICANTS

FISKE BROTHERS REFINING CO.
129D Lockwood Street, Newark 5, N. J.
Plants: Newark 5, N. J. and Toledo 5, Ohio

Circle No. 34 on Reader Service Card

dustrial processes. These systems will handle input to 15 KV, single phase or three phase, 25-60 cycles; Output ratings to 100,000 amperes, single phase, two phase, three phase or direct current. Uses include electric furnace control, anodizing aluminum, coating of magnesium, electro-chemical processing, etc.

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PORTABLE SAND BLASTER

ALC COMPANY — The Model B "Sandy Jet" sand blaster is a new portable unit that features more power and finger-tip control. It has a pistol-grip type blast gun and can use all types of abrasives with the three sizes of nozzels.

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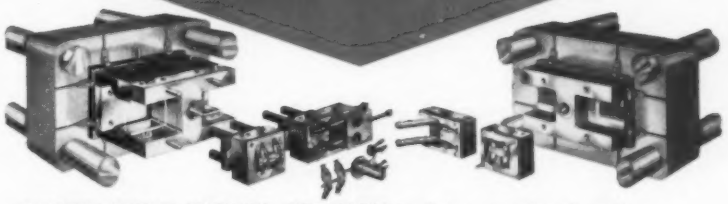
Circle No. 101 on Reader Service Card

SAVE 70% with MASTER-MOLD



MASTER-MOLD WORKS FOR YOU to bring overhead and operating costs down to a realistic level. **MASTER-MOLD** can save you up to 70% because this new technique eliminates expensive die sets and other costly equipment — slashes set-up time, labor costs . . . **handles two jobs at once.**

Short runs can be handled profitably! Short runs, long runs can be combined, run together — doubling your machine capacity!

Now you can add to your customers the many small manufacturers and experimental workers who cannot bear the cost of conventional die-casting methods.

. . . write for complete information, or order direct.

RICHARDS TOOL AND MOLD CO.

2715 LATHROP AVENUE • RACINE, WISCONSIN

PICTURED ABOVE IS OUR MODERN SHOP AND OFFICES

exclusively devoted to engineering and building die casting dies and molds to exacting specifications. This plant was designed with capacities to handle and fabricate anything from a unit die insert to a 15 ton cylinder or grille die with the necessary skills and experience to save you time and money on your next tool.

RICHARD O. SCHULZ CO.

ELMWOOD PARK, ILLINOIS

•

DIE CASTING DIES • PLASTIC INJECTION AND COMPRESSION MOLDS

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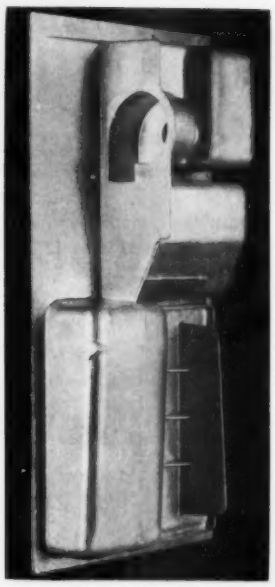
Reduce machining
— part costs with a

Permanent Mold Casting



The conversion of this large Main Housing, 34" x 16" x 8", from a sand casting to a 23 lb. permanent mold casting in 356 Aluminum, brought about two savings. First, the savings on the casting for 1200 pieces were large enough to pay for the mold. In addition to the savings on the piece price, the close tolerances of a permanent mold casting eliminated many costly machining operations.

Other advantages include casting the housing to these specifications: It must be pressure tight. It must be cast flat to ± 1/32.

We Welcome Your Inquiries

ECC Eastern Casting
CORP. DIVISION
THE EASTERN MALLEABLE IRON CO.
69 South Williams St.
NEWBURGH, N. Y.

Circle No. 32 on Reader Service Card

NEW PRODUCTS *continued*

FINE HOLE DRILLER

HUNTER TOOL — An ultra-fine hole driller has been introduced for mill or drill press. The unit features the 'Albrecht' micrometer chuck or the small Jacob's. The driller has an accuracy of .0002 and features finger tip control.

Circle No. 247 on Reader Service Card

TIMING SEQUENCE HEAD

VALVAIR CORP. — A universal timing sequence head for use on Valvair Speed King and Inline

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Eliminate shrinkage and cracking in aluminum permanent-mold castings with

Foseco DYCASTAL

an improved "boiling flux"

This bulletin tells you how. Send for your free copy today.

Foseco
FOUNDRY SERVICES, INC.
P. O. Box 8720, Cleveland 35, Ohio

AUTO-DIESEL'S NEW
TIP & RING
PLUNGER
COMBINATION

6 MONEY SAVING ADVANTAGES

1. Longer wear
2. Denser castings
3. Eliminates aluminum pick-up on sleeves
4. Reduces tip changing down-time
5. Eliminates buying or making new tips
6. You can salvage and use your old tips

Greater Efficiency

Solves problem of scored or worn tips—saving thousands of dollars per year for the die casting industry.

Beryllium copper and steel plunger rings on piston tips result in maximum service life.

Catalog on Request

Plus—Auto-Diesel now offers stainless steel liners for goosenecks—increasing present life 4 to 1—literature on request.

THE AUTO-DIESEL PISTON RING CO.
3141 Superior Avenue • Cleveland 14, Ohio

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Here's *the* master check list of iron powders—highlighting the outstanding properties of Hoeganaes Iron Powders. If yours is a special problem, take a second look at this list . . . locate that grade best suited to your specifications. Then, call in the HSIC service specialist . . . he'll answer all detailed questions.

MH-100

Known throughout the powder metallurgy industry as the "work horse" of the industry. Famous as the world wide standard for uniformity, compressability, iron carbon parts production and copper infiltration.

MH-100-S
EP-1024

Equally famous for the properties above, plus improved compressability and purity. The "right" powder for production of large parts or higher density parts.

ANCOR 80

On down over the years, Ancor 80 is still the outstanding choice for green and sintered strength.

PRE-MIXES

You too, like so many parts fabricators, can eliminate your mix department worries. It's just this simple. Let HSIC produce and guarantee the proper composition for your requirements. HSIC now offers and supplies every conceivable iron base mix . . . including low alloy steel compositions for outstanding strength and other physical properties.

STAINLESS

. . . and other nickel, iron and cobalt base alloys. These powders, which are atomized in an atmosphere, have very low silicon contents when desired. They have excellent briquetting properties and can be sintered at the same temperatures and times that are used for ordinary iron powder.

When it comes to metal powders selections . . . be sure to

specify HOEGANAES

HOEGANAES

. . . the complete line of metal powders that give you the properties you want—for the metal parts properties you want to produce

HSIC

HOEGANAES

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fosteria), Edmonton (Alberta, Canada), Los Angeles, Minneapolis, New England (Elmira, N.Y.), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

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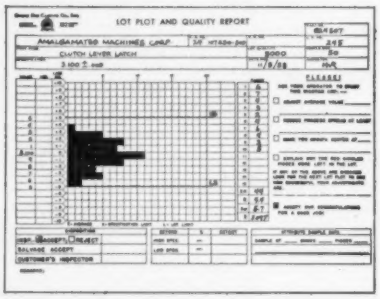
Circle No. 74 on Reader Service Card

STROH INTRODUCES
STATISTICAL QUALITY CONTROL
FOR DIE CASTINGS

DIMENSIONAL CONTROL
AT STROH DIE CASTING
BEGINS WITH A CHART
LIKE THIS . . .



Here's what the new concept of Quality Control at Stroh Die Casting means to you

CRITICAL DIMENSIONS
can be held within specified limits. Buyers who rely on statistical dimensioning to assure accurate parts for assembly are invited to consult Stroh.

LOWER INSPECTION COSTS
come from simpler receiving inspection instead of full sampling of each shipment of die castings. Many manufacturers now benefit from Stroh's Quality Control.

Write for Details

IN OUR 56th YEAR

Stroh Die Casting Co., Inc.

11123 WEST BURLEIGH STREET
MILWAUKEE 10, WISCONSIN

NEW PRODUCTS *continued*

Valves eliminates the need for timers and relays in circuits requiring time delay in valve function. The head will time in, time out or both time in and time out. Delay in valve function from 0 to 30 seconds is provided by the head. The delay can be extended to several minutes by connecting an accessory reservoir.

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MARKS HOT SURFACES

MARKAL CO. — Markal Paintstik Markers will mark hot surfaces permanently. The markers can be used for heat treating, annealing and other hot surface applications. Marks will not char, run or burn.

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STRONG FIREBRICK

BABCOCK & WILCOX CO. — has introduced a strong insulating firebrick that is light in weight and low in thermal conductivity. The mechanical strength of B & W K-20 and K-23 has been increased.

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Serving the Die Casting Industry

SINCE 1944 . . .

with . . . a complete line of interchangeable replacement parts for the injection end of aluminum and zinc die casting machines

THESE REX-BUCKEYE ENGINEERED PRODUCTS . . .

- Goosenecks
- Nose Inserts
- Plungers
- Piston Rings
- Plunger Couplings
- Nozzles
- Machine & Breakdown Pots
- Shot Sleeves
- Plunger Tips
- Plunger Rods

Complete rework service on goosenecks, plungers, shot sleeves and plunger tips.

R·B

For All Types & Sizes of Die Casting Machines

Rex-Buckeye Co.

ATlantic 1-6718
2109 W. 41st ST., CLEVELAND 13, OHIO

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- Complete Design and Engineering Service

- Modern Plant and Equipment

- Highly Skilled Moldmakers

- Over 100 Men to Serve You

Your Product Deserves...

ATOLS
Ultra-Precision MOLDS

We are proud to have won recognition as one of the leaders in this highly specialized field — serving the Die-Casting and Plastics Industries. For more than 25 years, our facilities and services have been utilized by an ever-increasing list of blue-chip companies. We cordially invite you to take advantage of our facilities, our know-how, our reputation for precision-made molds — promptly delivered and economically priced.

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when it's for precision die-casting...

specify TADANAC zinc

Zinc offers more desirable mechanical qualities and casting characteristics at a lower cost than any other metal. For the very best in die-casting zincs, specify TADANAC BRAND — or alloys made from it.

For information and assistance regarding zinc die-casting, contact our Technical Service Staff. Your inquiries will be given immediate attention.

With TADANAC BRAND Zinc you get electrolytically refined zinc of consistent high quality, low in impurities and always in good supply with prompt delivery assured.

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED

COMINCO

Metal Sales Division: 215 St. James Street W., Montreal 1, Quebec, Canada

Sold in United States by: **AMERICAN METAL CLIMAX, INC.,** New York, Chicago, Detroit, Los Angeles

TADANAC ZINC SHAPES THE THINGS TO COME

9101

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Improve surface finish, increase die life and control casting solidification with

Foseco®

DYCOTE

coatings for permanent molding and die casting components

This bulletin tells you how. Send for your free copy today.

Foseco®

FOUNDRY SERVICES, INC.

P. O. Box 8728, Cleveland 35, Ohio

SHELL MOLDS

continued from page 67

the mix will rise from a room temperature of 80° to a maximum of 100° F. The solution will be cooled down, completely hydrolized and ready to use, after about 2 hours.

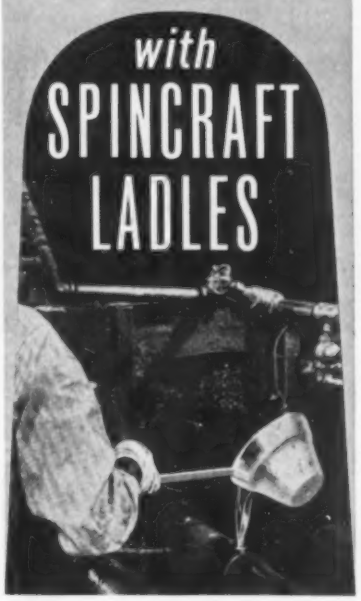
Different batch preparations — especially ones having different degrees of temperature rise — may give different gelling times in response to the same amount of gel accelerator. As the hydrolized material ages, it will gel more rapidly with the same amount of accelerator.

Trial gels should be made before trying to fill a core because (1) the working time is so strictly limited, (2) it may vary due to the way that the ethyl silicate was hydrolized, and (3) it is different for the liquids alone than for the liquids plus the refractory powder.

Before the mix is poured, plug the core at the bottom by pressing a flat piece of tacky wax across the opening. Pouring is best done slowly on a vibrating surface, since vibration will help flow from the container and will help air bubbles

POUR EASIER, POUR FASTER, MORE POURS PER LADLE

with SPINCRAFT LADLES



Light, rugged, Spincraft ladles save replacement costs, make every pouring job easier! Available in a vast range of sizes, in stainless steel as well as mild.

• LIGHT IN WEIGHT LESS FATIGUE!

• NON-SPILL SHAPE NO WASTE!

• EQUIPOISED HANDLE BALANCED!

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SKILL WILL DO IT

Division 2-0730

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MILWAUKEE 8, WISCONSIN

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3rd in a series of POWDERED METAL PARTS applications by REESE

COST AND SERVICE STORY

behind Reese Powdered Metal Knobs for Bernz-O-Matic Ceramic Grill

From John B. Spiggle, Purch. Agent for the Otto Bernz Co., Inc.: "Our present brass powdered metal knob was evolved from a smaller knob that was re-designed from a screw machine part to reduce cost. When we required a larger but similar knob on another product, we immediately thought of powdered metal. Reese received the order for this new part because their price and delivery were better than others who had quoted. We have continued to do business with Reese because their prices have been in line and their service and quality better than our other sources for powdered metal parts."

FREE BROCHURE "How to Cut Precision Parts Cost with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.

Remet

REESE METAL PRODUCTS CORPORATION

537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets Oilless Bearings • Bushings • Machine and Structural Parts in COPPER • BRASS • IRON • ALLOY STEEL • NICKEL SILVER • COPPER INFILTRATED IRON

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THE PIERCE-WALLER

AIR-LUBE

SYSTEM

CUTS COSTS for DIE-CASTERS

- CLEANS
- LUBRICATES

Remove loose flash and clean the mold with a powerful, clean air blast — then lubricate all mold surfaces evenly, *using the same gun* —with a flick of the thumb! Adjustment *at the gun* for full range from zero to a heavy mist, spraying, fogging, or vaporizing the lubricant. Speeds up mold operation and reduces casting rejects. Makes every machine cycle count.

USED IN LARGE AND SMALL SHOPS EVERYWHERE!

WRITE FOR *FREE* FOLDER

PIERCE-WALLER, INC.

P.O. Box 2121A • DAYTON 29, OHIO

***Plant:* RAJAK MFG. CO.**

Specialists in polyester impregnation of metals

245 N. Fourth St. • Tipp City, Ohio

Circle No. 62 on Reader Service Card

SHELL MOLDS *continued*

break and escape up one wall of the core as the slurry pours down.

As soon as the core stiffens, the wax plug may be removed. It may help to key the ends of the core by pushing in a larger Nalcast crystal or a broken bit of ceramic just before the core hardens. Otherwise, the ends of the core should be roughened by scratching to promote a good bond to the shell itself.

Immediately after the cores have set, the shell may be formed, providing that a thin shell (about three coats, such as for aluminum) will be made. If the core is to be surrounded by a heavier, less flexible shell, it is better to dry the core overnight to allow for full shrinkage. This will minimize any tendency to crack.

As a general rule, gating should allow metal to flow smoothly around all sides of a core at once when the molten metal is poured. Even the best and strongest of cores may warp if the hot metal hits one side of a core first and then the other side a moment later.

SAVE: TIME WORK DOLLARS

on your aluminum alloy casting operations with the

***Stahl* AUTOCAST**

Automatic Permanent Mold Casting Machine

- **PORTABLE...** Both machines can be moved as a unit to different furnaces for casting different alloys.
- **FAST...** Automatic Timer eliminates human error. Dies easily interchanged. Dies need less maintenance of refractory coating.
- **ACCURATE...** Timer has 3-second graduations from 0 to 5 minutes; counter records cycles to 9,999; jog buttons for "inching" mold in either direction.

We can adapt your molds to the AUTOCAST, or make new dies to your specifications.

Send for our technical brochure.

STAHL SPECIALTY CO.

KINGSVILLE, MISSOURI

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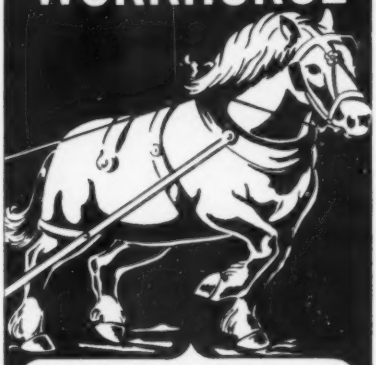
your industrial

WORKHORSE



DURACAST

investment

DURACAST is an industrial "work-horse" type of investment and will produce consistently high casting yields.

KERR DURACAST

is a Non-Ferrous investment specifically formulated to give:

• High permeability • High green mold strength • High burn-out strength • Resistance to thermal shock • Resistance to mechanical and casting shock • Maximum flask and furnace life (it does not contain any corrosive or acid producing ingredients.)

For Non-ferrous Metals

K-90
DURACAST
DURACAST-20

For Ferrous Metals

FERROMOLD

Write for our New Industrial Products Catalog

KERR MANUFACTURING CO.

6081 Twelfth St. • Detroit 8, Michigan

DEALERS

CASTING SUPPLY HOUSE • New York, New York
DICK ELLS CO. • Los Angeles, California

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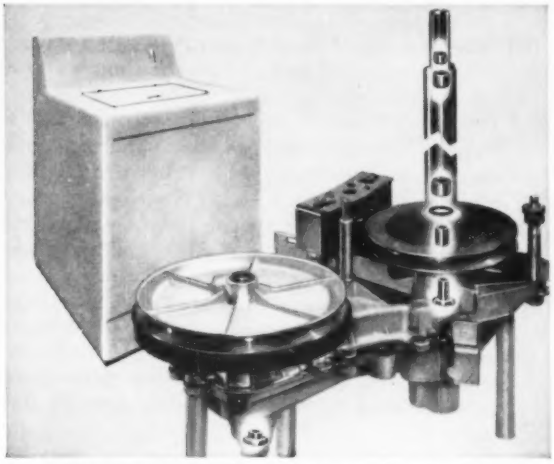
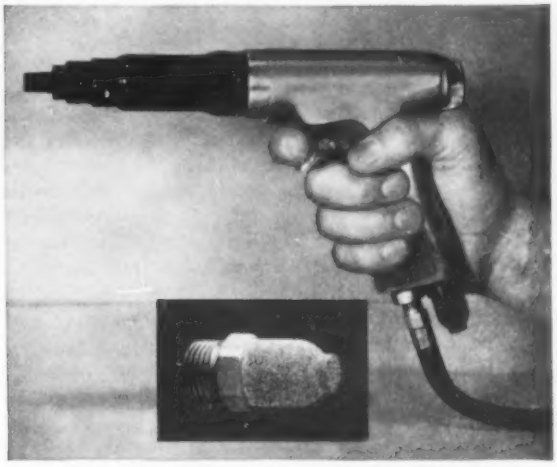
BOOST PRODUCT APPEAL with OILITE

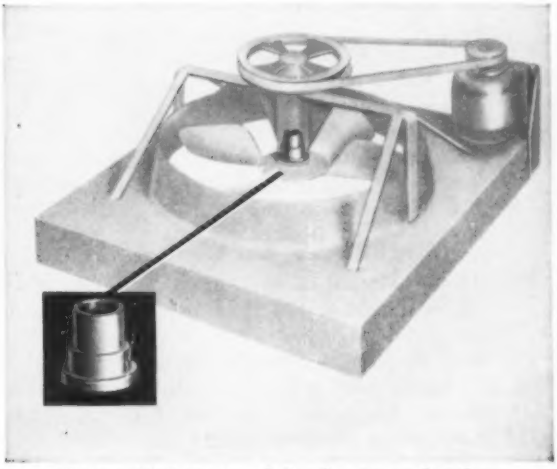


This "best seller" automatic washer is more reliable, more economical with Oilite oil-cushioned bearings.



Oilite filter-diffusers are now boosting the sale of new air tools by making them practically "noiseless".

Dust, grit, shocks — plus payloads up to 34 tons — are all in a day's work for these tough Oilite bearings.



This self-lubricating Oilite bearing refused to fail even after 125 years' service in accelerated life tests.

Quality-built OILITE®* bearings, parts and filters help sell many products by improving performance and keeping costs down. Mass-produced at Amplex's 2 modern plants, even the most intricate parts are die-pressed directly into ready-to-use, close tolerance shapes. Amplex engineering, research and production know-how can probably help you. Why not contact your Oilite representative today? Look for him in the Yellow Pages under "bearings—Oilite" or write Dept. L-11.

* *Only Chrysler Makes Oilite*

PM MEMBER SINCE 1929

A CHRYSLER PRODUCT — OILITE

the most trusted name in powder metallurgy!

AMPLEX DIVISION

CHRYSLER CORPORATION, DETROIT 31, MICHIGAN

SELF-LUBRICATING BEARINGS • PRECISION PARTS • METAL FILTERS • FRICTION UNITS

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USEFUL LITERATURE, CATALOGS, MANUALS

Qualified readers may obtain any of these free technical publications by circling the numbers on the Reader Service Cards facing Page 114

PROCESSES

144 **Sinterings** — MUELLER BRASS CO. — 12-page brochure on the company's facilities for making powder metal parts, impact extrusions and precision parts by five other fabricating methods.

145 **Sinterings** — TECHNAMETALS, INC. — Bulletin describes the products and processes available to users of powdered metal parts from the company.

146 **Forgings** — BRIDGEPORT BRASS CO. — 9-page technical bulletin on the process includes data on free cutting phosphor bronze, a free machining alloy with a rating of 80.

147 **Cold Extruded Parts** — BURGESS-NORTON MFG. CO. 4-page technical bulletin on the process of producing cold extruded metal parts.

148 **Investment Castings** — ILLINOIS PRECISE CASTING CO. — 12-page technical brochure describes the process and the company's facilities for producing precision investment castings.

149 **Extrusions** — OLIN MATHIESON CHEMICAL CORP. — Brochure on cold processed rod and screw machine stock.

150 **Investment Castings** — MISCO PRECISION CASTING CO. — Vol. 2 No. 4 of Casting About with Misco features data on investment castings in the Lycoming T-53 Gas Turbine Engine.

151 **Extrusions** — THE BABCOCK & WILCOX CO. — Brochure tells how to cut costs by using extruded alloy mechanical tubing.

MATERIALS & EQUIPMENT

152 **Platinum-Group Metals** — METALS & CONTROLS — 8-page brochure describes the company's platinum-metal products.

153 **Metal Spinning** — SPINCRAFT, INC. — "Notes for an Engineer's File" is an informative monthly news sheet on solving metal forming problems.

154 **Die Casting Machines** — KUX MACHINE CO. — 29-page technical brochure gives complete specifications on the various size and models of Kux die casting machines.

155 **Materials Research Furnace** — CURTIS-WRIGHT CORP. — Data sheet on a high-temperature resistance furnace for research and development. It's designed for continuous operation at 4,800°F.

156 **Density Determination** — ENGINEERED MATERIALS — 11-page technical report on heavy liquids for sink-float density determinations in quality control and research.

157 **Processing Secondary Metals** — FRANKEL CO., INC. — 16-page brochure on processing high alloy secondary metals. Contains details on 36 alloying materials.

158 **Indicators & Controllers** — GENERAL ELECTRIC CO. — 10-page bulletin gives data and specs on electric indicators and controllers for low cost measurement and control.

159 **Spectrochemical Instruments** — BAIRD-ATOMIC, INC. — Brochure describes operation and applications of Emission Spectrochemical Instruments.

160 **Processing Ovens** — HEVI-DUTY ELECTRIC CO. — 6-page bulletin describes batch type and semi-automatic continuous industrial heat processing ovens.

161 **Stuccoing Equipment** — ALEXANDER SAUNDERS & CO. — Data sheet gives specifications on a fluidized bed unit for applying refractory grain to make shell investment molds.

162 **Metal-Mesh Conveyor Belts** — CAMBRIDGE WIRE CLOTH CO. — Data on a new technique in manufacturing metal-mesh conveyor belts where new crimp wheels crimp the transverse wire at an angle. Belts of this type are used in sintering furnaces.

163 **Tool Steel** — UDDEHOLM CO. OF AMERICA, INC. — 12-page technical bulletin on Tri-Tung high-carbon, high-chrome air and oil hardening tool steel for long production runs.

178 **Compacting Tools** — GENTRY CARBIDE TOOL & DIE CO., INC. — 8-page brochure shows the company's facilities for making draw dies, swaging dies, compacting tools, blanking dies, jigs and fixtures.

FINISHING

168 **Abrasive Recommendations** — THE CARBORUNDUM CO. — 57-page catalog lists over 1600 abrasive wheel recommendations for grinding everything from Agate to Zirconium.

169 **Phosphating Compound** — TURCO PRODUCTS, INC. — Data sheets on a low temperature phosphating compound that operates at a temperature as much as 70 degrees lower than required by conventional phosphating processes.

170 **Ultrasonic Cleaning Primer** — NATIONAL ULTRASONIC CORP. — 12-page data booklet serves as a guide to potential users of ultrasonic cleaning equipment.

171 **Coatings** — DOW CHEMICAL CO. — 44-page products catalog lists properties and uses of some 375 industrial chemicals. Includes a section on coating products.

172 **Cleaner** — MACDERMID, INC. — 5-page data sheet on the Alumetex Process for preparing commercially used aluminum alloys for any type of electrodeposit.

173 **Torque-Sensitive Driver** — SCULLY-JONES & CO. — Data on a torque-sensitive driver for use in manual-feed drilling and reaming operations that features an adjustable clutch to disengage the tool when breakage is eminent.

174 **Plating & Polishing News** — HANSON-VAN WINKLE-MUNNING CO. — A quarterly brochure that will keep you abreast of the latest equipment, supplies and processes in the plating and polishing industry.

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Molten aluminum can't wet, can't harm the precision-formed parts shown here. These parts and fittings for aluminum die-casting and direct-chill castings are all made of REFRAX® silicon-nitride-bonded silicon carbide. They are Carborundum's answer to the need for a material that can be formed into intricate parts with outstanding corrosion resistance far above normal melting temperatures. REFRAX shapes are solving many problems in aluminum holding furnaces and aluminum alloying furnaces (including reverberatory and induction).

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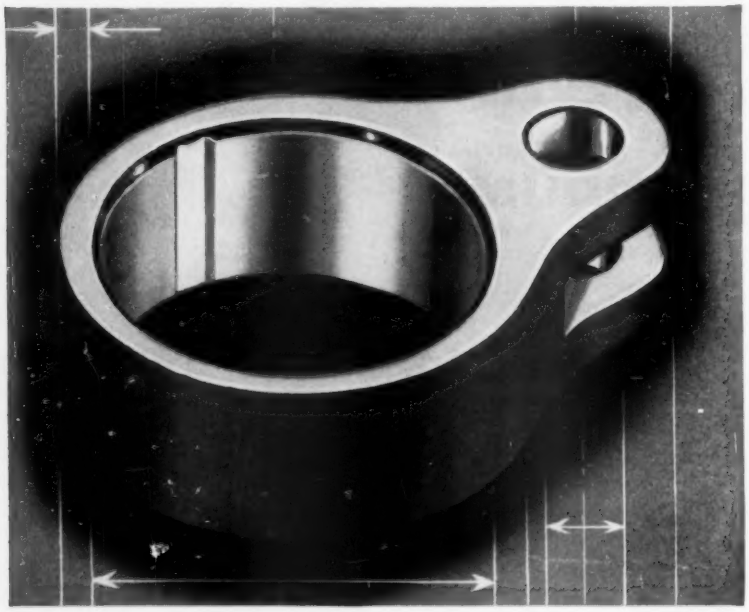
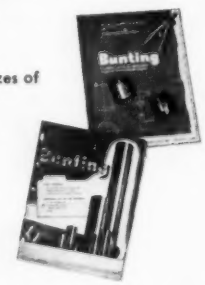


BUNTING SALES ENGINEERS in the field and a fully staffed Product Engineering Department are at your command without cost or obligation for research or aiding in specification of bearings or parts made of cast bronze or sintered metals for special or unusual applications.

...ask or write for your copy of...

Bunting's "Engineering Handbook on Powder Metallurgy" and Catalog No. 58 listing 2227 sizes of completely finished cast bronze and sintered oil-filled bronze bearings available from stock.



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Leading manufacturer of die casting machines and powder compacting presses require sales representative for Ohio - Pennsylvania - Western New York area. Good drawing account commission basis. Must be willing to travel and reside in Cleveland - Pittsburgh area. Send complete resume of qualifications and experience. Replies will be held in strict confidence. Box 11359.

Sales Representatives — Progressive Eastern Die Caster requires men to sell Zinc Die Castings. Excellent territories open for qualified men. Commission basis only. Address full details to Box 11159.

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PRODUCTION SUPERINTENDENT

Rapidly-expanding die casting company located in smaller Midwest city offers an excellent opportunity for qualified man, to participate in growth of company. Must have experience in light metals die casting. State education and compensation requirements. Box 11659.

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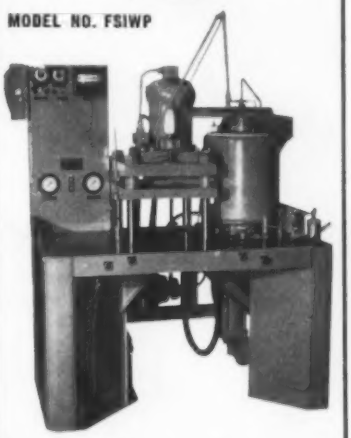

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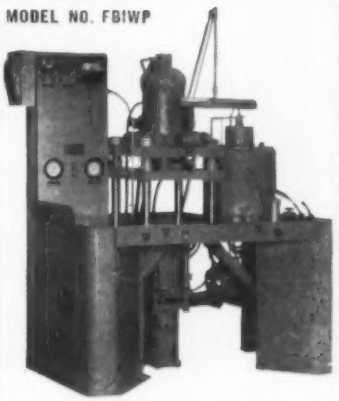
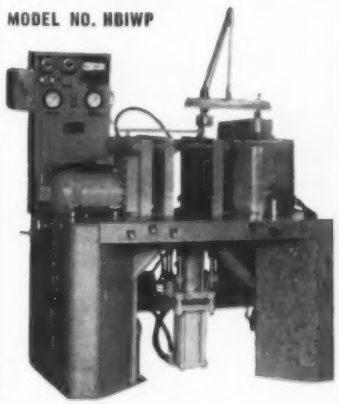


MODEL NO. HBIWP



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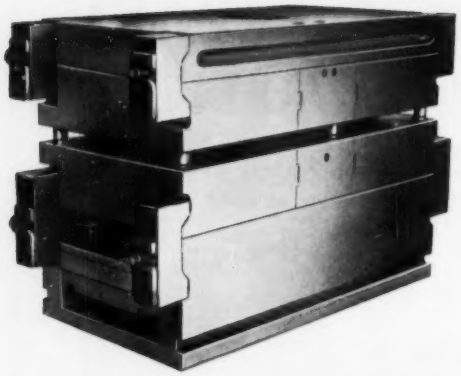
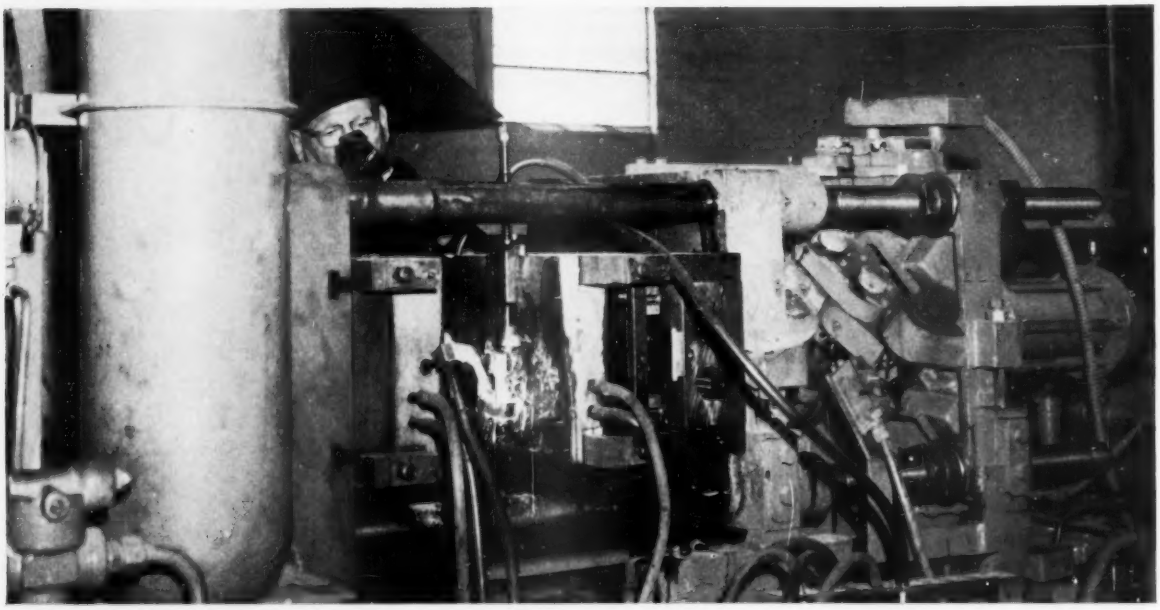


SAVE ON SHORT RUN DIE CASTINGS!

CHANGE DIES IN MINUTES!

With D-M-E Standard Unit Dies for Zinc or Aluminum Die Casting



Cut Die Costs and Save Time with Stock Replacement Units

DIE CHANGES that normally take 3 to 5 hours are done in minutes with D-M-E's Standard Unit Dies for zinc or aluminum die casting.

Standard interchangeable Replacement Units are *in stock* now to reduce your die costs and shorten delivery schedules.

D-M-E's Standard Unit Die assembly offers these unique features for added savings in production time and maintenance:

Construction permits complete freedom on *three sides* of the cavity for placement of cores or cooling lines; six sturdy leader pins and bushings provide accurate alignment and trouble-free performance; and "quick change" wedge clamps for positive positioning of each plate.

Standard Replacement Units are quickly positioned in the Unit Die Holder by a precision T-slot in the mating edge of the plates; there is no interference with the cavity layout.

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D-M-E Unit Die Holders are available for Standard 10" x 12" or 12" x 15" Replacement Units.

Start saving *now* on your short-run die-casting jobs with D-M-E Standard Unit Dies.

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Write **TODAY** for Complete Specifications

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- D-M-E of CANADA, Inc., TORONTO, ONT.: 156 Norseman Ave.

Circle No. 26 on Reader Service Card

INDEX OF ADVERTISERS

A

Acheson Colloids Co. 27
Ajax Engineering Div.
Ajax-Magnethermic Corp. 21
Allied Research Products, Inc. 79
Almco, Queen Products Div.
King-Seeley Corp. 85
Aluminum & Magnesium, Inc. 2
Aluminum Smelting &
Refining Co., Inc. .....Cover II
American Metal Climax, Inc. 25
American Sintsel Corp. 11
American Zinc Sales Co. 15
Amplex Div.
Chrysler Corp. 105
Apex Smelting Co. .....Cover IV
Arwood Precision Casting Corp. 16
Atols Tool & Mold Corp. 101
Auto-Diesel Piston Ring Co. 98

B

B & T Machinery Co. 57
Babcock & Wilcox Co., The
Tubular Products Div. 10
Bethlehem Steel Co. 26
Wm. L. Bonnell Co., Inc. 65
Bunting Brass & Bronze Co. 108

C

Carborundum Co., The
Electro Minerals Div. .....80 & 81
Carborundum Co., The
Refractories Div. 107
Cast-Master
H-P-M Div., Koehring Co. 1
Casting Supply House 109
Celanese Corp. of America .....12 & 13
Certified Alloys Co. .....Cover II
Chrysler Corp., Amplex Div. 105
Cleveland Automatic Machine Co. 9
Conforming Matrix Corp. 86
Columbia Tool Steel Co. 90
Consolidated Mining & Smelting
Co. of Canada Ltd. 102
Crucible Manufacturers' Association 84

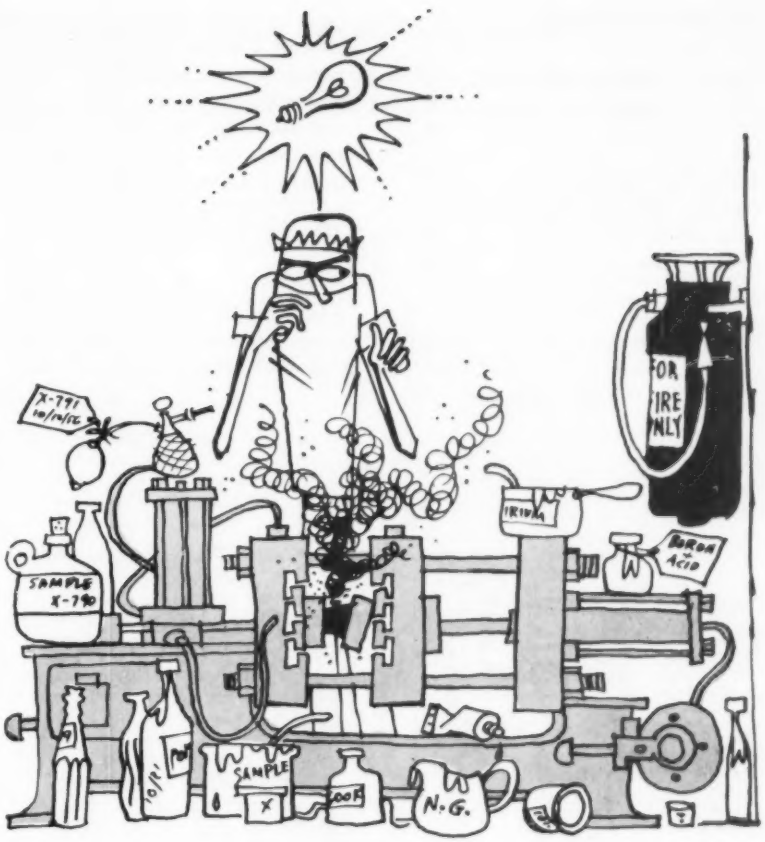
D

Damon Tool & Engineering Co., Inc. 87
Detroit Mold Engineering Co. 110
Dodge Steel Co. 95
Dollin Corp. 20
Dow Metal Products Co., The
Div. of The Dow Chemical Co. 31
Du-Co Ceramic Co. 90

E

Eastern Casting Corp. Div., Eastern
Malleable Iron Co., The 98

continued on next page



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New No. 44 Die Slick for aluminum die casting prevents sticking and soldering better than anything else tried, say leading die casters. No. 44 is the only compound that thins with water for regular jobs (eliminates smoke and fire hazard, reduces storage space) and thins with kerosene or solvent on tough jobs (bright clean finish, easy release).

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Circle No. 71 on Reader Service Card

AD INDEX *continued*

Errington Mechanical Laboratory, Inc. 86
Ettco Tool & Machine Co., Inc. 87

F

Federal Die Casting Co. 90
Fiske Bros. Refining Co. 96
Foote Mineral Co. 30
Foundry Services, Inc. 98, 103

G

Greenlee Bros. & Co. 57
Gries Reproducer Corp. 94

H

Hammond Machinery Builders, Inc. 82
Hampden Brass & Aluminum Co. 88
Henning Bros. & Smith, Inc. 112
Hoeganaes Sponge Iron Corp. 99
Hoover Co., The .....Cover III
Houghton & Co. E. F. 93
Hydraulic Press Mfg. Co.
Div. Koehring Co. 1

I

Inductotherm Corp. 17
Indussa Corporation 92
International Minerals & Metals Corp. 114

K

Kerr Mfg. Co. 104
Kux Machine Co. 71

L

Latrobe Die Casting Co. 38
Latrobe Steel Co. 6
Lester-Phoenix, Inc. 7
Leyden Hydraulics, Inc. 109
Lindberg Engineering Co. .....35, 36 & 37
Litemetal Dicast, Inc. 87

M

Madison-Kipp Corp. 24
Milwaukee Die Casting Co. 96
Misco Precision Casting Co. 22
Mueller Brass Co. 11

N

Neilson Chemical Co. 86
New England Die Casting Co. 40

O

Oakite Products, Inc. 83
Olin Mathieson Chemical Corp.
Metals Div. 29

P

PMD Extrusion Die Co., Inc. 23
Paramount Die Casting Co. 34
Peerless Gear & Machine Co. 96
Permanent Mold Die Co., Inc. 23
Pierce-Waller, Inc. 104
Precise Castings, Inc. 92
Precision Extrusions, Inc. 4
Premier Die Casting Co. 5

R

Reese Metal Products Corp. 103
Republic Steel Corp. .....32 & 33
Rex-Buckeye Co. 100
Richards Tool & Mold Co. 97, 109
Roto-Finish, Inc. .....76 & 77

S

St. Joseph Lead Co. 91
R. O. Schulz Co. 97
Smith & Sons, Inc., G. W. 111
Spincraft, Inc. 103
Stahl Specialty Co. 104
Stroh Die Casting Co., Inc. 100
Sutton Engineering Co. 39

T

A. Triulzi 89

U

Union Carbide Chemicals Co.
Division of U.C.C. 18
Universal-Cyclops Steel Corp. 72

W

WaiMet Alloys Co. 19

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DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards facing the last page will get you these free reference materials. Circle the numbers and mail.

1. **Lubrication** — Technical Data on graphite-water base dispersions for forging lubrication is available from Acheson Colloids Co.

4. **Sinterings** — Engineering Bulletin 3020 from American Sinteel Corp. gives technical data on ferrous and non-ferrous powdered metal products and their design.

6. **Metal Powders** — Handbook C-14 gives technical data on AMCO non-ferrous metal powders. American Metal Climax, Inc.

9. **Investment Casting** — "Practical Guide to Investment Casting", is a 44-page design handbook from Arwood Precision Casting Corp.

11. **Plunger Rings** — Literature on The Auto-Diesel Piston Ring Company's tip and ring plunger combination that solves the problem of scored or worn tips.

12. **Die Casting Machines** — Complete details on a line of high-pressure cold-chamber and hot-chamber die casting machines in capacities from 125 to 1,000 tons. B & T Machinery Company.

13. **Extrusions** — Technical Bulletin TB-413 tells how job-matched extrusions reduce the cost of finished products. Babcock & Wilcox Co.

15. **Sintering** — The "Engineering Handbook of Powder Metallurgy" and Catalog No. 58, which lists 2,227 sizes of completely finished cast bronze sintered oil-filled bearings, are available from Bunting Brass & Bronze Co.

16. **Refractory Shapes** — If you work with aluminum holding or alloying furnaces, you should get data on refractory shapes from the Refractories Div., The Carborundum Company.

17. **Die Casting Machines** — Complete line of Cast-Master die casting machines is described in Catalog CM-100. H-P-M Div., Koehring Company.

19. **Fire-Resistant Fluids** — Technical Bulletin on Cellulubes that are available in six ranges of viscosity. Celanese Corp.

24. **Crucible Melting** — "Getting the Most from Crucible Melting" is a new technical bulletin from the Crucible Manufacturers' Association.

25. **Die Casting Dies**—Brochure shows the company's complete engineering facilities for making die casting dies. Damen Tool & Engineering Co., Inc.

26. **Standard Unit Dies** — Literature from Detroit Mold Engineering Co. tells how to make die changes in minutes when die casting zinc or aluminum.

29. **Die Castings** — 16-page facilities brochure shows the company's die casting techniques for solving rigid design requirements in zinc and aluminum die castings. Dollin Corp.

30. **Investment Casting Cores** — Du-Ceramic, a new material for investment casting cores, is described in technical literature from Du-Co Ceramic Co.

34. **Metal Working Lubricants**—for all methods of working aluminum and aluminum alloys are described in literature from Fiske Bros. Refining Co.

35. **Improves Surface** — finish, increases die life and controls casting solidification. Technical bulletin on Foseco Dycote for permanent molding and die casting components. Foundry Services, Inc.

36. **Eliminate Shrinkage** — Technical bulletin tells how Foseco Dycastal, a boiling flux, eliminates shrinkage and cracking in aluminum permanent mold casting. Foundry Services, Inc.

38. **Small Parts Problem?** — A solution might be found in informative bulletins from Gries Reproducer Corp. on small zinc die castings.

39. **Die Casting**—"Behind the Scenes" is a report from Hampden Brass & Aluminum Co. on their facilities for handling your aluminum and zinc die casting requirements.

40. **Zinc Die Casting Facts** — Henning Bros. & Smith, Inc. has issued an engineering data book on "Die Casting With Zinc Base Alloys."

43. **High Temperature Lubrication** — "Thermal Lubrication," a new data booklet on high temperature lubrication from E. F. Houghton & Company.

45. **Air or Vacuum Melting** — Bulletin 20-30 from Inductotherm Corp. describes the Inducto Integral 30, an efficient and economical melting unit for a variety of applications.

47. **Investment** — Duracast, a non-ferrous investment, is just one of the industrial products described in Kerr Manufacturing Company's catalog.

48. **Die Casting Machines** — Catalog illustrates the features and models of the full line of Kux Machine Co. die casting machines.

50. **Die Steel** — Technical data sheet on VDC Type H-12 hot work steel that is easy to machine, responds uniformly to heat treatment Latrobe Steel Co.

51. **Die Casting Machines** — Lester-Phoenix, Inc. wants you to check the specifications on their die casting machines if obsolete equipment is stealing your profits.

53. **Die Castings** — Design data from Litemetal Dicast, Inc. on aluminum, magnesium and zinc die castings.

60. **Die Castings** — Brochure from Paramount Die Casting Co. serves as a brief guide to designing for die castings and shows the company's facilities.

62. **Cleans, Lubricates** — That's what the Air-Lube System, manufactured by Pierce-Waller, Inc. does. Technical data sheets are available from the company.

64. **Extrusions** — "P-E Extrusioneering News", a new bulletin from Precision Extrusions, Inc., shows cost-cutting solutions to various design problems.

65. **Vacuum Die Castings** — Literature on vacuum die castings and the Premier Die Casting Company's facilities for producing them.

67. **Sintering Savings** — A technical report, "How to Cut Costs With The Remet Powdered Metal Process" is available from Reese Metal Products Corp.

68. **High Strength Powder**—Technical book ADV 1028 gives the preliminary information on Type HS6460 High Strength Powder that has excellent carbon compatibility for higher stressed parts.

72. **Ladles**—Technical data and prices are available from Spincraft, Inc. on their line of stainless steel ladles.

73. **Automatic Casting Machine** — Technical bulletin from Stahl Specialty Co. describes the Stahl Autocast, a automatic permanent mold casting machine for your aluminum alloy casting operations.

74. **Statistical Quality Control** — for die castings. Technical literature from Stroh Die Casting Co., Inc. describes their use of quality control for lower inspection costs.

75. Extrusion Presses—processing machines. Bulletins 25 and 50 from Sutton Enginering Co. give technical data on a complete line of hydraulic extrusion presses, bar, tube and shape straighteners, roller levellers, detwisters, etc.

77. Fire-Resistant Fluids — The booklet "Ucon Hydrolubes Spell Safety" is available from the Union Carbide Chemicals Co.

78. Die Steel — Thermold AV, a vacuum degassed die casting die steel, is said to assure longer production runs. Details are available from Universal-Cyclops Steel Corp.

80. Corrosion Protection — Technical manuals from Allied Research Products, Inc., tells about chromate conversion coatings and clear protective coatings.

81. Finishing Equipment — Almco, Queen Products, Div., King-Seeley Corp. has issued an album of new products which contains brochures on a spindle machine, Vibrasheen, and price lists on compounds and media for barrel finishing.

82. Controlled Barrel Finishing—Manual contains technical data on a system of controlled barrel finishing, CARBOtrol 7. Gives data on all types of abrasive media, barrel finishing compounds, and machines and equipment. The Carborundum Co., Electro Minerals Div.

83. Automatic Finishing Machines — Clamps and fixtures, mask washing machines, and spray painting masks are described in technical literature from Conforming Matrix Corporation.

84. Multiple Hole Drilling — Data on fixed center drilling heads with jigs and fixtures for multiple drilling of holes on production runs. Errington Mechanical Laboratory, Incorporated.

85. Drilling, Tapping Heads — Engineering data on 5 models of circle or straight line type multi-hole drilling and tapping heads. Ettco Tool & Machine Co., Inc.

86. Rust Stripper — Bulletin 9651 describes Rustripper, a alkaline material with powerful cleaning and chelating action. Oakite Products, Incorporated.

87. Vibratory Finishing — Technical bulletin describes the Vibratron, for precision finishing of parts faster than by barrel finishing. Roto-Finish Co.

100. Flat Finishers — for grinding, polishing and deburring in one operation are presented in technical data. Hammond Machinery Builders, Incorporated.

101. Master-Molds — and cavity blocks for aluminum and zinc die casting. Information is available from Richards Tool & Mold Company on how you can save up to 70% because this new technique eliminates expensive die sets and other costly equipment.

102. Unit Die Blocks — and ejector plates. Cavity blocks, said to give you practically 100% productive area, are described in a catalog sheet from Richards Tool & Mold Company.

ARWOOD NAMES MAIN

MAIN

ARWOOD PRECISION CASTING CORP. has appointed George Main assistant sales manager. In his new duties he will be responsible for customer relations, sales representatives, and Arwood manufacturing plants.

HUDSON BAY
SPECIAL HIGH GRADE ZINC — 99.99%
International Minerals and Metals Corp.
11 Broadway
New York 4, N.Y.
One Fine Zinc For Die Casting

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If it's experience you're after...

call a Hoover Man

Some folks with experience and that certain touch can do the impossible. We aren't making any wild claims about the aluminum and zinc alloy castings we produce. But we've been satisfying our customers—many of them for 35 years. We make quality castings. Make 'em for lots of different companies. Why not call us? We'll have one of our experienced Sales Engineers give you the whole Hoover story.

THE HOOVER COMPANY, Die Casting Division, North Canton, Ohio
In Canada – Hamilton, Ontario

Die Casting specialists since 1922

DIE CASTING *by* HOOVER

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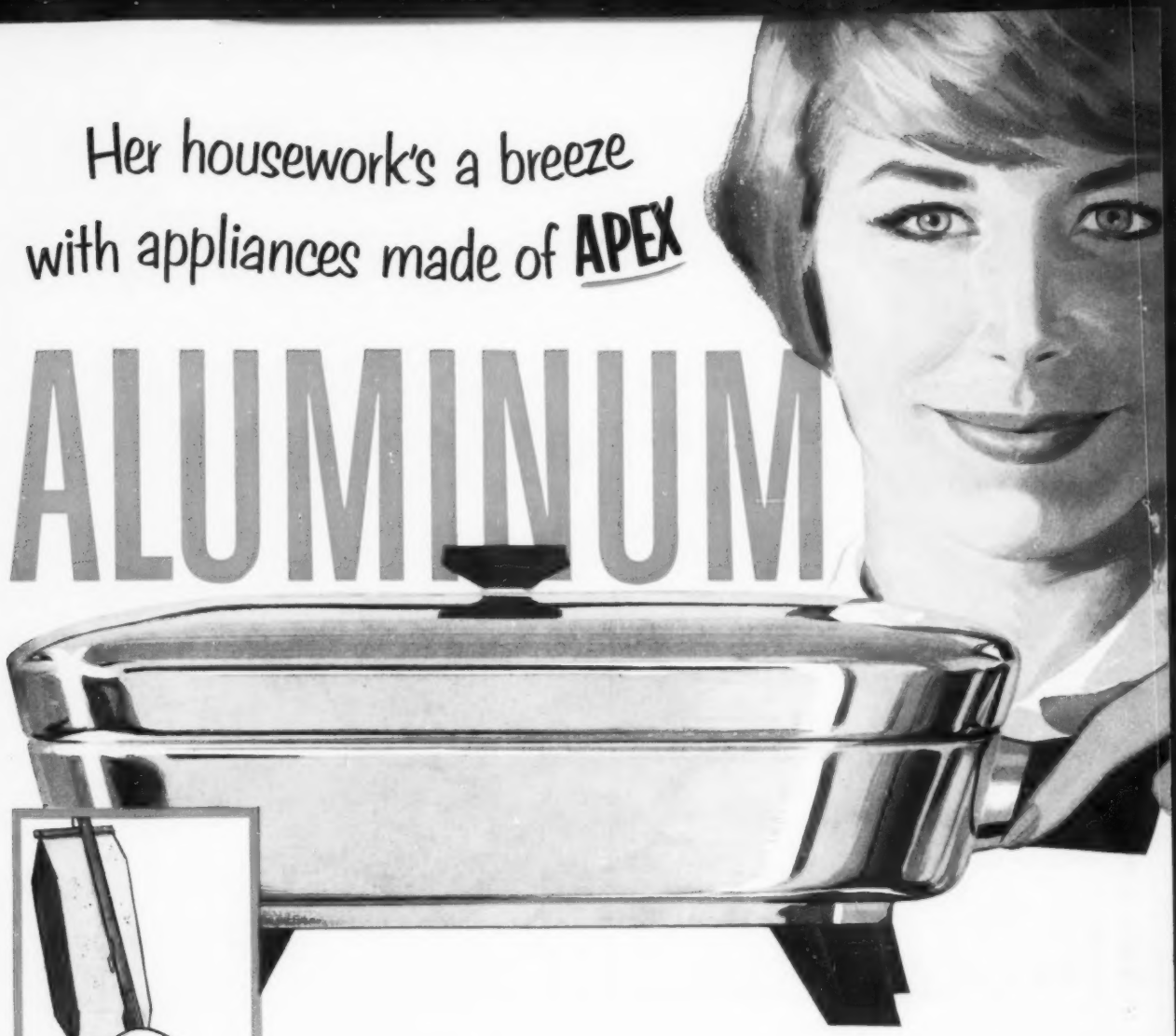
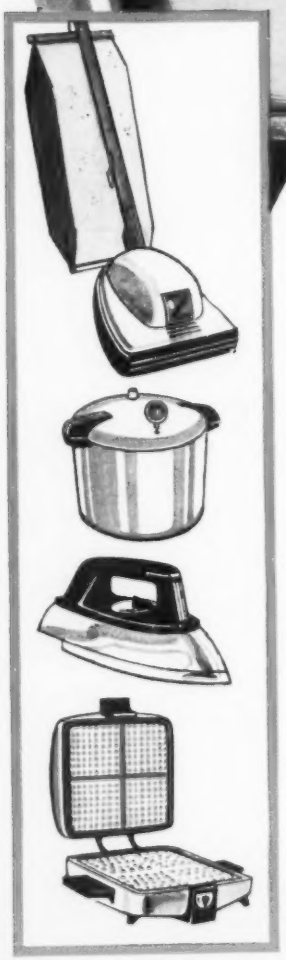
Her housework's a breeze with appliances made of APEX

ALUMINUM





Today's homemaker manages a neat, well-run household and still enjoys a full share of leisure time—with a big assist from aluminum and its modern, work saving applications.

She finds new convenience with aluminum pans and utensils that protect the taste of food, clean easily, heat quickly and evenly . . . she benefits from the better operation that strong, durable aluminum cast parts bring to her electric iron, vacuum cleaner, electric grill and scores of other appliances.

Apex and its metallurgists work closely with the foundries and die casters who serve the appliance industry. Custom and standard aluminum alloys, produced by Apex to rigid specifications, provide the performance and quality you want in these modern day work savers.

Research leadership back of every ingot

APEX SMELTING COMPANY

Producers of ALUMINUM, MAGNESIUM AND ZINC ALLOYS

CHICAGO 12 CLEVELAND 5 LONG BEACH 10, CAL.
SPRINGFIELD, OREGON (National Metallurgical Corp.)

Your products may also be produced better and more efficiently with the help of aluminum castings. Apex Smelting and the companies it serves in the die casting and foundry industry stand ready to assist you and your engineers.

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